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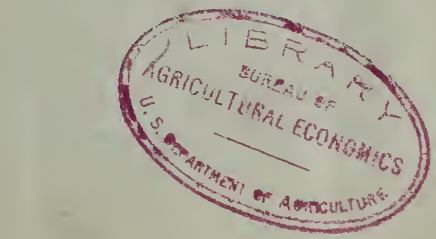

REPORT OF THE

Secretary of Agriculture

1938

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Contents

	Page
Sources of the agricultural maladjustment	1
Evolution of the ever-normal granary	9
Old and new proposals for farm relief	16
Law promotes abundance and democracy	25
The A. A. A. program for 1939	34
Crop insurance provided for wheat growers	37
Marketing agreements and surplus removal	41
Coordinating research, planning, and administration	47
National aspects of land use planning	54
Underprivileged groups in agriculture	59
Looking toward farm security	63
Farm-land values and farm credit	68
Farm-tax system affects land utilization	71
Economic democracy in forest and range areas	74
Demonstration and research in soil conservation	78
Wildlife areas in land programs	81
Some effects of technical progress	85
Discussion groups clarify farm problems	90
Farm income, prices, and production in 1938	91
Price spreads between country and town	96
The foreign trade situation	98
The Sugar Act of 1937	100
Administration of commodity exchanges	104
Weather reports and investigations	105
New goals in agricultural research	110
"New-use" research expanded	114
Agricultural engineering has wide scope	119
Wider uses developed for dairy products	124
Plant science buttresses crop and soil program	127
Social objectives of forestry	133
Developments in animal industry	135
Surveys show consumption trends and needs	140
Progress in insect pest control	144
Extension service emphasizes economic information	148
Personnel administration	150
New law improves food and drug control	152
Litigation affecting the Department	153
Our changing highway needs	156

REPORT OF THE

Secretary of Agriculture

1938

WASHINGTON, DECEMBER 1, 1938

To the President

SOURCES OF THE AGRICULTURAL MALADJUSTMENT

In trying to appraise our national agricultural policy we must come to some agreement as to the objectives. Therefore, I shall begin this report with a survey of the present shape of American agriculture and of its economic environment. The usual account of production, prices, and farm incomes for the current year will come later. As is well known, American agriculture is not in a good adjustment to its market. We cannot know what should be done without first knowing the extent and character of the maladjustment, and having some idea of the causes and probable developments. In the space at my disposal I cannot give an adequate description of the agricultural industry and of its setting in the world economy, but I can indicate the outstanding features. Then we can discuss programs and proposals with some assurance that they will be judged in terms of the actual requirements.

In the United States, where farm-production power greatly exceeds the purchasing power and with some crops the needs of the domestic population, the objectives of the national agricultural policy differ profoundly from those of deficit-agricultural countries, whose first necessity is an adequate food supply. Here the problem is economic more than technical; in other words from the national standpoint it is essentially a problem of marketing rather than of deficient production. As we saw recently, it takes several years of crop failure to cause even small domestic shortages. Normally, our task is to prevent surpluses from beating down prices, and to maintain a satisfactory balance between production on the farms and production in the factories.

It was not so formerly. On the contrary, the problem formerly, in fact until after the World War, was to expand the agricultural output steadily to meet a steadily increasing demand at home and

abroad. Many people believed in 1933 that only an emergency farm program was necessary; they believed the elimination of the surpluses that existed then would clear the way for a return to the old system of unlimited production. It is evident by this time that we face a more or less permanent problem in agricultural adjustment, the sources of which lie deep in changed domestic and foreign conditions. I wish briefly to describe first our agricultural industry and second the market situation or economic environment to which we must adjust it. Usually parallel and reciprocal in their evolution, the two things have grown apart. When we know why, and to what extent, we shall be in a better position to judge our farm programs. It is useless to see them against an imaginary background of conditions as they used to be and will probably never be again. We must look at them against the background of things as they are, and of the conditions and forces that have shaped these things.

Farm Expansion and Specialization

It is the past, of course, that shapes the present, and largely determines what we must do now. Until less than a century ago the agricultural conquest of this continent was a slow-moving procession through one of the largest and densest forests in the world. Then came the rapid settlement of the grasslands. This was a movement, in general, to better soils. It promoted farm proprietorship by farm operators, retarded tenancy, and increased production vastly. Along with the agricultural expansion westward went an increasing specialization of farm functions.

Many farmers a century ago were also artisans, merchants, teachers, doctors, and lawyers. Gradually they surrendered various functions to the cities. Science and invention revolutionized the agricultural technique. Indeed, the revolution continues. Our farmers now pay the city people something like about $1,500,000,000 annually for power and power machinery; whereas, before the World War, they sold power to the cities in the form of work animals worth several hundred million dollars annually. This specialization and mechanization of agriculture, along with the building of railroads, made agriculture increasingly commercial. In 1929, for example, products sold or traded constituted 87 percent of our farm production.

Meantime, our population increased prodigiously. We had a large excess of births over deaths and also heavy immigration. Before the Civil War population doubled each quarter century. After the Civil War the rate of increase diminished but the actual number increased, until between 1920 and 1930 the increase exceeded 16,000,000—a number almost equal to the total population of Canada and Australia. This increase went largely to the cities. By the close of the World War migration to the West, except to the Pacific Coast States, had practically ceased.

Europe's population likewise increased rapidly in the nineteenth century. We imported capital from Europe as well as immigrants.

Growth of population in Europe and the necessity to repay with interest the capital that we had borrowed gave us a rapidly expanding market for agricultural products. American agriculture responded with a rapidly increasing production, which aided the further growth of urban populations in both hemispheres.

Output Per Man Increased

In the last hundred years the production per worker engaged in agriculture in the United States has increased threefold. In crop production the increase per worker was probably 25 percent from 1850 to 1860, probably 50 percent from 1850 to 1900, and probably 30 percent between 1900 and 1930. In the post-war decade, 1920–29, the crop production per worker increased less than 10 percent; but the total agricultural production per worker, including livestock and livestock products, increased about 25 percent. Between 1910 and 1930 the increase in agricultural production per worker was about 41 percent.

Moreover, mechanical power largely supplanted horses and mules and released the feed from 35,000,000 to 40,000,000 acres of crops for meat and milk animals. Also, the farmers shifted their livestock classes from the less productive to the more productive animals per unit of feed consumed; notably, from beef cattle to dairy cattle, hogs, and chickens. They improved their feeding and breeding practices, and greatly reduced the mortality of their livestock. In 1930 the average American farmer, after providing for himself, for 3 other persons in his family, and for a hired laborer, produced food and fibers for 12 people in American cities or elsewhere than on farms, and for 2 more persons in foreign countries. Full use of the available acreage, agricultural science, and machinery would have enabled him to support still more people.

Until after the World War the national and world economy encouraged this growing productivity. Europe took our products liberally, and the market at home expanded. Moreover, the farm population declined relatively to the total population. Only 21 percent of the American people who were gainfully employed were in agriculture in 1930, as compared with about 70 percent a century ago. The proportion now is probably about 25 percent. A similar proportion of the occupied population are engaged in manufacturing and mechanical trades. The proportion of the gainfully employed in distribution has practically doubled in 50 years. Trade and transportation, including associated clerks, now employ almost as many people as do the manufacturing and mechanical trades combined. Over one-fourth of the gainfully employed are in the services—clerical, domestic, personal, public, and professional. From one-fourth to one-half of the farm youth left the farms for the cities each decade between 1870 and 1930. This transference of personnel from farm to nonfarm occupations helped greatly to keep agriculture in balance with industry.

Profound Changes After World War

Suddenly we became aware of profound changes in some of these factors: Notably, the rate of growth declined in the domestic population; immigration ceased; the cities became unable to absorb rural youth as they had previously done; depression and unemployment reduced the buying power of wage earners; there were no more frontiers; and foreign countries became unable, for various reasons, to maintain their purchases of American farm products. American agriculture entered an era of resistance to its further expansion. It became intensely concerned with marketing.

As a partial remedy it has been suggested that we should diminish our imports of agricultural commodities. These consist mostly of noncompetitive things such as silk, rubber, bananas, tea, and coffee. Among the competing products that we import the most important are sugar, flaxseed, and wool, which can be produced on the whole more cheaply in foreign countries than in the United States. All told, however, we import, of crops that could be grown in the United States, the equivalent of the production of only 10,000,000 to 15,000,000 American acres. Our exports-producing acreage is much greater. Any further restriction of our agricultural imports would react adversely on our exports. What we import enables foreign countries to buy our exports; if they could not sell and buy here they would sell and buy elsewhere.

More important to us is the trend in our farm exports, which has been declining almost steadily since the early 1920's. In the peak year of the 1920's our farm exports required the production of over 80,000,000 acres. They required the production of about 70,000,000 acres during the 5 years before the depression. Since then they have required only the production of from 20,000,000 to 50,000,000 acres, mostly of cotton. The export demand may even decline further.

Relation to World Market

American agriculture grew up to supply the world market as well as the home market. When its production for export cannot be sold, or can be sold only at a very low price, crops produced for the domestic market drop in price too. It is then impossible, without special remedial measures, to prevent ruinous disparities between farm and nonfarm incomes. Appeasement in European politics may moderately improve the situation. Even then, however, the outlook will be less favorable than it was before the depression, though it may be better than it is now.

Our trade-agreement program, and the work of various semiofficial and private agencies, are gradually improving the outlook for trans-Atlantic trade. But we cannot expect the restoration of our trade with Europe to predepression levels. No other area can absorb our crops in quantities sufficient to make up for the European reduction.

It is virtually certain that in one way or another we shall have to limit our production for export and take steps to guard the domestic market from the influence upon it of bargain-counter prices abroad.

In cotton we may expect to continue our exports at about the present level. The United States still supplies nearly 50 percent of the world's cotton imports. Moreover, the world's cotton consumption has remained at a high level and may rise in the next few years. The outlook for our wheat exports is less favorable. World wheat imports have dropped about a third since 1929, as a result largely of increased production in the importing countries. Though this expansion in production may be near its limit, it will probably not turn back. Competition will be keen for the limited wheat market in Europe among the wheat-surplus countries, principally Canada, Argentina, Australia, and the United States. Even if we keep the share of the trade that we had in the 1920's, the volume of it will be considerably lower.

In tobacco the export outlook is relatively favorable. Recent developments, however, threaten our leading position. The United Kingdom, which ordinarily takes about 50 percent of our flue-cured exports, now gives a preference to tobacco from the British Dominions and India. This policy may decrease our proportion of the total. China, which formerly took from one-fourth to one-third of our flue-cured exports, greatly expanded its domestic production prior to the hostilities with Japan. Though our exports of flue-cured tobacco may not decline in quantity, our proportion of foreign tobacco consumption may decline. Fruits have been the most rapidly expanding group of our farm exports during the present century. Expansion in these exports will probably be less rapid from now on, though the outlook is for continued large fruit exports.

Consumption in the United States

Turning to the domestic market, we see changes in food consumption—in kind rather than in aggregate per capita quantity. The consumption of cereals, for example, has declined notably in the last few decades, while the consumption of sugar, of green vegetables, and of citrus fruits has increased. The trend of total consumption per capita has been stationary or slightly downward. Even the depression did not greatly change the diet of the American people, though the per capita consumption of milk, including milk products, dropped 2 percent between 1929 and 1933. With farm production still abundant, the domestic consumption continued in almost predepression quantities. But the growth of population is slowing down. The domestic market now requires only about half as much annual increase in production as it required 10 to 15 years ago. Only a small increase in our harvested acreage will be necessary to provide for the probable future increases in population, even if the demand for exports remains undiminished. Should the export demand decline, or if mechanization continues to supplant horses and mules, or if technological improvement continues, no

increase in cropland may be necessary before the Nation's population becomes stationary.

In the outlook for American consumption of farm products the most important single factor and probably the dominant factor is the population prospect, in which, with immigration negligible, the controlling influence is the number of births. Since 1924 the decline in births has been almost continuous. The number of births annually is now only 2,200,000 to 2,300,000, as compared with nearly 3,000,000 in 1921. Each year since 1930 the enrollment in the first grade of the public schools has declined about 100,000; now the enrollment in the elementary schools as a whole is declining. The crest of the Nation's population will probably be reached by the 1950's or 1960's, when the total population may be 10,000,000 more than it is now. Fifty years hence, according to present statistical indications, the population probably will be declining materially and will contain a much larger proportion of middle-aged and old people than it does at present. Needless to say, this development will greatly affect the demand for agricultural products.

It will probably reduce first the consumption of milk, since city children at least apparently consume from 50 to 100 percent more milk per capita than adults. On the other hand, the domestic demand for cereals and meats may increase, even after the population begins to decline. Eventually, however, the expected decline in population will cause a decline in the domestic consumption of farm products. The experience of the last three decades does not warrant the expectation that consumption per capita of farm products as a whole will increase. Meanwhile, population trends in northern European countries will affect our exports, though doubtless less strongly than other factors such as the trend toward economic nationalism. In European countries that formerly took most of our food exports, the population is almost stationary and probably will soon decline.

Ratio of Rural to Urban Population

Another aspect of the population problem that affects American agriculture greatly is the distribution of the population between town and country. In depression years, the outlook is for a less rapid increase in urban than in rural population; and in cities, where deaths exceed births, as is the case in several large cities at present, a decrease in population may occur. During the recent depression more than 1,000,000 young farm people remained on farms who would normally have gone to the cities. They could not get work in the cities.

Approximately 6,000,000 persons, mostly of farm origin, moved back to the farms. They sought food and shelter with relatives and friends or started little farms of their own. The agricultural census reported 2,000,000 of these people still on the land in 1935. Apparently, New York, Detroit, and Chicago declined in population during the depression. Migration from the farms to the cities, which declined to about 600,000 net during the years 1930–34 as compared

with 3,000,000 in the preceding 5-year period, doubtless will revive in periods of prosperity; but there are no signs as yet of a sufficient increase in urban work to absorb the excess rural manpower. It is wholly improbable that the trend in the twentieth century will resemble that of the nineteenth. Agriculture may find itself with an increasing personnel, rather than an increasing market.

Another tendency should be noticed in the prevailing agricultural situation. Along with the growing congestion in the rural population in many parts of the Nation goes a decline in farm ownership by farmers. This has been most notable in commercial areas where the farm population has remained stationary or declined. Farmward migration and growth of farm population during most of the nineteenth century meant increased land ownership by land operators. Migration from farms during most of the twentieth century, and inheritance by heirs who have moved to town, resulted in transfer of farm ownership to city people. Except in the Northeastern States, farmers in most parts of the country have been slowly losing the ownership of the land for half a century.

This loss shows up in the statistics of tenancy and mortgage debt. Farm land rented in 1935 constituted more than 45 percent of all the farm land in the country as compared with only 31 percent in 1900. Tenants, including croppers, operated 42 percent of all the farms in 1935, as compared with 25 percent in 1880. Tenancy is growing very rapidly in the richest agricultural States. Tenants in 1935 operated 50 percent of the farms in Iowa and 58 percent of the farm land was under lease. Rent paid by farmers in the United States to nonfarmers in 1935 is estimated at $699,000,000, in 1936 at $743,000,000, and in 1937 at $829,000,000.

Mortgage debt constitutes an increasing proportion of the value of farm real estate. In 1910 the mortgage debt was about half the gross farm income; in 1930 it was practically equal to the income. In 1909 the interest paid on mortgage debt was about $200,000,000; in 1936 about $400,000,000. The debt load has about doubled during the last quarter of a century. In 1880 the equity of farm operators in farm real estate in the United States as a whole was about 62 percent of the value of all farm real estate. By 1930 the proportion had fallen to 41 percent, and by 1935 to 39 percent.

Operators' Stake in Farms and Buildings

The proportion of the farm land and buildings in the Nation really owned by farm operators has fallen from nearly two-thirds to less than two-fifths in 55 years. The decline has been about 4 points each 10 years, in periods of prosperity as well as of depression. Continued at the same rate for another half century the decline would reduce the farm operators' share of farm real estate to one-sixth. The other five-sixths would belong to absentees. In the Corn Belt this proportion is approaching rapidly. Farm operators in Illinois and Iowa in 1935 owned, above mortgage debt, only 28 and 24 percent, respectively, of the value of all farm land and buildings. In the wheat

regions the equity of farm operators in the farm real estate ranged from 20 percent in South Dakota to 35 in Montana. Farmers have been much more successful in retaining the ownership of land in the Dairy Belt.

Declining farm ownership is an important cause of soil erosion and soil depletion. Tenants and farm operators with only small equities have small incentive to practice conservation and are often almost forced by rent or interest payments to plant the most productive crops, notably corn and cotton, which, being intertilled, facilitate erosion. Soil erosion in the United States has seriously impoverished approximately 282 million acres of land. From an additional 775 million acres erosion has stripped away from one-fourth to three-fourths of the fertile topsoil. Considering only cropland, erosion has ruined about 50 million acres for further practical cultivation. Another 50 million acres of cropland are bordering on the same condition. Nearly 100 million acres more, still largely in cultivation, have been severely damaged by the loss of from one-half to all of the topsoil. On at least another 100 million acres of cropland erosion is getting actively under way.

Need for Government Action

These conditions necessitate governmental action. There is no way for the farmers individually to deal effectively with the partial loss of the export market, the rapid approach of stationary populations, and the increasing rural congestion in many areas that results from industrial depression and unemployment. Nor is there any individual remedy for the fact that technology increases farm production per agricultural worker, while other forces contract the market. Some people believe agriculture should decommercialize itself and become more self-sufficient. That would be a backward step. Moreover, the resulting reduced purchasing power of farmers would force some urban people into subsistence farming. Agriculture needs to get back on a business footing, and well-conceived national programs must help it to do so.

There is no escaping the necessity to adjust the farm output through measures that will not drive farmers from their farms. There is no escaping the further necessity of finding new outlets or of providing marketing controls to deal with surpluses when they accumulate unavoidably. Also, we must arrest the increase of tenancy and increase the equities of owner operators. Left uncontrolled, the prevailing trends will tremendously increase these evils. With farm youth backed up on farms and with the urban unemployed flocking to the country in periods of depression, land hunger is likely to produce absentee landlordism. These problems constitute an obvious national responsibility.

This Department and its action agencies carry only part of the responsibility, for the problem is urban as well as rural. It involves our whole economy. It will help us to understand the specific agricultural requirements if we bear in mind the historical and economic

developments above described. No one who understands them can propose a mere let-alone policy. It is absolutely impossible for the Government to stand aside. The debate narrows down to what the Government should do. Let us consider, therefore, what it has done in recent years and more particularly in 1938. This will give us a basis for considering what further steps should be taken.

EVOLUTION OF THE EVER-NORMAL GRANARY

Against this background of history and economics let us examine the farm program that we have in operation. We are now in the middle of the first year's operation of a new Agricultural Adjustment Act. It is timely to glance at what the act contains, to indicate the origins and application of its more important principles, and to notice some of the difficulties involved. The act is a coordinating and integrating measure based on our experience during the period 1933–37, first with the Agricultural Adjustment Act of 1933 and then with the Soil Conservation and Domestic Allotment Act of 1936. It represents the main stream of our developing agricultural policy. It embodies principles hammered out in nearly two decades of Nation-wide discussion on the farms, in the cities, and in Congress. Indeed, to a considerable extent it includes principles unwittingly championed as substitute proposals. In short, the Agricultural Adjustment Act of 1938, and the programs in operation under it, are the Nation's well-matured answer to the challenge of an undisputed need for profound agricultural readjustments.

There is so much in the act that I will mention at this point only the outstanding features. What follows will indicate some of the applications. There are five titles in the measure. Title I continues with amendments the Soil Conservation and Domestic Allotment Act with its provisions for acreage allotments and benefit payments. Title II gives the Secretary of Agriculture authority to participate in proceedings before the Interstate Commerce Commission with regard to freight rates on farm products and also provides for the establishment of regional laboratories to develop new uses, markets, and outlets for agricultural commodities. Title III concerns commodity loans and marketing quotas; the object of this title is to provide facilities for an ever-normal granary. Title IV deals with cotton-pool-participation trust certificates, and title V with Federal crop insurance with wheat designated for the first experiment. We can best understand the act by reviewing briefly the farm adjustment experience of the last 6 years.

Theory and Method in Rapid Change

Theory and method change continually in the evolution of our agricultural adjustment system. Inevitably, they become more comprehensive and refined. This is only natural; it is the counterpart of what goes on in every field of knowledge and action. All problems look simpler at first than they eventually prove to be, and the

first means adopted for coping with them of necessity give place to measures of greater precision, refinement, and effectiveness. Once the amateur could build a radio set; he still can build one but his product will not rival that of the highly specialized and intricately developed industry. Agricultural adjustment looked simple to many people in its infancy in 1933. Now we realize that it involves, not merely the reduction of surpluses, but frequently the expansion of production in various lines, the maintenance of adequate reserves against shortage in drought years, the conservation of the soil, and the harmonious development of a better rural-urban balance.

In 1933, with an immense accumulation of the leading crops on hand, agricultural adjustment was mainly a problem of producing less of those products for which the European demand at a fair price had disappeared. Everyone agreed that the surpluses would have to be got out of the way. Two courses lay open: (1) Competitive crop curtailment through farm bankruptcy and farm abandonment; and (2) concerted crop adjustment with Federal guidance. Rural and urban opinion united at that time in approving the latter course. It was clear that the plight of the farmers was no fault of their own. It was equally clear that the competitive method of reducing the surpluses would drive farmers off the land and into the city bread lines. This would have been a worse remedy than the disease. Since public agencies had fostered the preceding farm expansion, Congress with the evident support of public opinion authorized them to deal with the subsequent farm reaction.

Additional Requirements Recognized

In the first emergency, the A. A. A. programs envisaged primarily crop curtailment, with soil conservation as a byproduct. They protected individual cultivators from eviction, and saved thousands of farms from neglect and deterioration, and that was all to the good. There was a direct immediate benefit to the cities. In keeping the farmers on the land, while at the same time helping them to reduce the farm output, the early A. A. A. programs reduced the national unemployment total, directly by preventing an undue exodus of population from the country to the town and indirectly by enabling farmers to reenter the market for industrial commodities. Also, they checked the drift into so-called subsistence farming and rural poverty. But the first steps in crop adjustment took out of production efficient and inefficient acres indiscriminately. It became necessary to take longer views, and to plan the agricultural adjustment for additional ends. There was an equal need for better land use, balanced farming, and soil conservation.

With world trade throttled by tariffs, import quotas, bilateral trade restrictions, and exchange controls, there was no practical alternative to the American farm-adjustment policy. Geared to production for an abnormal market that was vanishing, and with land, labor, and capital far in excess of the domestic requirement, our agriculture had urgent need to prevent its export surpluses from

beating down the prices of all its products. Later, other requirements emerged. As the adjustment went along and the early surpluses diminished, it became necessary to consider the occasional lean year, and to combine production for a lessened world demand with precautions against crop failure. Exceptional weather conditions emphasized the necessity to maintain adequate crop reserves.

In its developed form, therefore, the adjustment policy becomes the ever-normal granary. This term is a good short description of the whole process. As the words imply, it covers far more than the concept of the first emergency period, when the predominant purpose was adjustment to the fact of a smaller world market. It promotes jointly the interest of producer and consumer through means that protect both parties—namely, the reciprocal action of acreage adjustment and crop storage. In the ever-normal-granary program there is room, as occasion requires, for expansion of the farm output. It rejects the notion that farm welfare always requires acreage reduction and looks instead to the production of different crops in the proper amounts and proportions. Moreover, it looks toward the stabilization of supplies through the conservation of soil and soil productivity. It does not waste land following seasons of overproduction but devotes it through conservational activities to the uses of the future.

Combining acreage adjustment, soil care, and protection for the consumer, the ever-normal granary compares with our first experiment in agricultural adjustment as the modern automobile compares with the horseless carriage. The program calls for production equal to the normal domestic consumption plus probable export requirements, and it makes also an allowance for a rise in the domestic consumption per capita. It provides the maximum abundance possible for commercial agriculture under the rules of the commercial game. The new act provides for parity payments on the normal production of the basic commodities when funds are available so that farmers have a direct incentive to meet all the requirements of the domestic market.

Program Obviates Scarcity

Farmers with the ever-normal granary can and do produce much more abundantly for city people than city people have been producing for farm people. In the first post-war depression of 1920–21 the output of urban industry dropped 33 percent. In the depression years 1929–32 it dropped more than 50 percent. In the recession of 1937–38 it dropped 33 percent. Farmers wonder why they of all people should be accused of scarcity. In 1937 their production of the 55 leading crops was 6 percent greater than in any previous year in the country's history. There is heavy farm production again this year. Ever-normal-granary programs, even in times of glut, will not reduce the farm output as much as industrialists reduce factory production in every slump.

Agriculture as well as the urban community has a vital interest in the consumer-protection features of the program. Without the good will of the consumer the program would lose the necessary legislative and financial backing. Agriculture must not only intend, it must effectively promote the welfare of the consumer, on pain of sacrificing his indispensable cooperation. Farmers understand this well; they have never wanted to turn the consumer's good will to the consumer's disadvantage; though to be sure they have not always fully understood that high prices do not necessarily mean high farm incomes. In the ever-normal-granary programs we have an increasing approximation toward a more socially desirable interplay of production, prices, and farm income, and toward more uniform consumption of larger quantities.

Those who believe the ever-normal granary is for the farmer only and not for the consumer emphasize two things: (1) The probability that farmers, if left to themselves, will produce more in good years than the market requires; and (2) the opportunity to supply occasional shortages through imports. It seems to follow from these two considerations that the consumer need not worry about the ever-normal granary. But it would be as short-sighted for the consumer to take that view as it would be for the farmer to think only of himself. Actually, within the framework of the adjustment system, the consumer has a common interest with the producer in the use of storage for the stabilization of market supplies. The consumer cannot safely depend on imports for increased supplies in the occasional lean year. Furthermore that would condemn the farmer to low prices in short-crop as well as in big-crop years. It would ruin the agricultural market for city goods and mean increasing urban unemployment.

Urban Dependence on Farms Many Sided

It is important to bear in mind that the consumer is not a mere passive recipient of finished agricultural goods, but a collaborator with the farmer in the country's business life. He takes farm goods, not just to eat and wear, but to process, distribute, and transport, and to combine with other materials in the production of industrial goods. Every nonfarm worker, near to or remote from farming, draws upon agriculture for two kinds of materials; one kind for immediate personal use, and the other kind for use as raw material in his own employment. Everyone, even the writer, the musician, or the sculptor, uses materials of agricultural origin in his work, such as fabrics incorporated in paper, furniture, and tapestries, and numerous things whose form may disguise their dependence on the farm. Moreover, the nonfarm worker depends on agriculture as a market. He provides the farmer with machinery, fertilizer, transportation facilities, containers of many kinds, lumber, paint, and other supplies, not to speak of newspapers, magazines, books, and motion pictures.

In considering agricultural conditions, he should think of many things beyond his basic need of food and clothing. He should recognize his interest in the farm as a going concern.

The consumer needs more from agriculture than just a supply of low-priced commodities. He needs the farmer as a customer; and he needs protection against a rush of population from the country to the town, such as would result inevitably from a ruined agriculture. City people have their profits and wages to consider as well as the prices of agricultural commodities. Their own incomes depend materially on farm income. Forcing down the incomes of the farmers destroys also the urban income structure. Moreover, abandonment of the ever-normal granary would only temporarily mean low prices for the consumer. After the American farmer had been driven out of business, the price for imported supplies would go up. In the long run it is neither desirable nor practicable for the consumer to obtain farm commodities at less than their value; nor is it good business for him to prefer a foreign to a domestic source of supply. Thus the ever-normal granary principle is as vital to the consumer as it is to the farmer.

Hazards of Commodity Loans

The machinery of the ever-normal granary provides for commodity loans under certain specified conditions of supply and price, and these loans involve certain hazards. The best protection against these hazards is a clear grasp of the purposes the loans should fulfill.

Obviously, since the ever-normal granary exists to carry surpluses from fat to lean years, the commodity loans should finance the storage and measurably stabilize the price of the stored commodities from one season to the next.

In terms of prices for commodities stored, the result should be a higher price level than would otherwise prevail in the big-crop years and a lower price level than would otherwise prevail in the short-crop years. In other words, the true function of the ever-normal-granary type of loan is to counteract fluctuations in market supplies and prices. It is not its function to maintain an average price level above that warranted by basic demand and supply factors.

Loans of the ever-normal-granary type apply particularly well to corn, provided the loan rates be conservative and in line with existing and prospective demand and supply conditions. Storage of corn in the ever-normal granary is a protection to the consumer of meat products in the occasional lean year and a means of smoothing out the hog and cattle cycles. The basis for loans on corn is somewhat different from the basis for loans on export crops. With corn the export problem does not figure. In a year of surplus production the corn loan should impound part of the crop for feeding to livestock in subsequent short-crop years. Hence the corn loan may at times safely be made above the market but such a loan requires the support of machinery for carrying out necessary crop adjustments.

Consumers notice changes in the supply and price of corn mainly through their effect on the prices of pork, beef, and poultry. Following a big corn crop both hog production and cattle feeding increase the following year; conversely, following a short corn crop, the supply of hogs and fat cattle declines and the prices advance. Wide fluctuations in the corn supply force producers in and out of their livestock enterprises with the result that the average costs over a period of years are higher than they would be otherwise. Stabilization of the supply and price of corn through the ever-normal-granary machinery and loans stabilizes also the supplies and prices of meat animals and their products.

In emergencies certain crops such as cotton, wheat, and corn may require loans of a different type for the support of prices without regard to the need for storing reserves. But such loans are highly speculative and risky, particularly for the export crops. It is impossible for a single country to fix the world price of a commodity produced and sold extensively throughout the world. Therefore, what the operation amounts to is simply a refusal to sell below a certain figure. It is speculative storage, undertaken in the hope of a rise in prices later. Should the hope not be fulfilled, the Government loses money and agriculture loses a part of its foreign market.

In considering a granary program for wheat, we should place first emphasis on crop insurance, and only secondary emphasis on wheat loans. With full participation of the wheat producers, the ever-normal-granary carry-over in years of short crops can materially help to protect wheat producers against crop disaster. It can protect consumers also, because the reserves will be available for sale and use in years of shortage. Different policies may be necessary for different types of wheat; but wheat is wheat and what we do with one type affects the other types.

This year we have a tremendous export surplus, and our immediate wheat program must be adjusted to that fact. We should sell the surplus without undue delay. Attempts to store it long, in the hope of a better market, would be costly. There is no possible chance of raising the world price and maintaining it at the higher level through storage operations. Our share in the world's wheat trade is far too small. The best course will be to aim at retaining our fair share of the world's wheat trade or say 100,000,000 bushels annually, and to follow an export-sales policy calculated to realize this objective. We should provide an adequate payment on the normal production on acreage allotments consistent with soil conservation and good farming practices. We should take prompt and effective steps for the adjustment of the wheat acreage next year, and we should be cautious in loan operations.

As for cotton, except in times of threatened price collapse, it is bad business to tie up the crop with loans. The operation merely substitutes domestic credit for actual foreign trade or domestic consumption; it contradicts the aim in view. Between the grower and

the ultimate consumer it interposes the Government, which must hold its stocks for a rise or take a loss. If we cannot let the exports go at the world price, we should not hold out for too great a rise. What we really need for cotton is liberal exportation, reasonable crop adjustment as a safeguard against excessive money loss in the foreign market, and supplemental income for the farmer through soil conservation and price-adjustment payments. Great progress has been made toward general understanding of these fundamental principles since the unfortunate high-loan experience of 1934 which curtailed exports unnecessarily in 1935.

Possible Causes of Excessive Loan Rates

Many things may cause loan rates to be set too high. Pressure from growers may result in wrong loan policies. Inadequate information may have the same result. It may be impossible to foresee at what point the loan on an export commodity will retard exports unduly, and delay consumption domestically. There are remote as well as immediate consequences to consider; among them the influence of the loan rate on production at home and abroad. The best net income for agriculture in the long run, and also the best results from the standpoint of the general welfare, depend on the maintenance of a correct balance between supply and price. Loans that ignore purchasing power and reduce consumption destroy this balance, and substitute a price structure that must eventually collapse. The best protection against unsound loan policies is widespread awareness of the probable results.

Extreme care must be exercised in administering the commodity loans under the new program. Loans on export commodities such as cotton and wheat should not be considered as price-raising measures. Other phases of the program attend to that. Loans may properly be used to prevent prices from declining too rapidly, and in emergencies actually to support the price; but in general they should be handled so as not to impound excessive supplies or prevent export crops from moving freely into foreign trade. Commodity loans at rates out of line with supply-and-demand conditions simply afford an opportunity for our foreign competitors to undersell us. They put the Government gradually into possession of increasing proportions of the total commodity supply, and into control of the marketing machinery. That need not happen if we follow a rational policy in determining loan rates.

These risks and problems make the ever-normal granary look formidable. And so it is. But dropping the granary principle would create a problem still more formidable. In the last 5 years the farm situation has changed from surplus to shortage and back to surplus again. Meantime, the world situation has confirmed the necessity of substituting coordinated action for competition as the means of adjusting supply to demand. More intensity in farm competition would mean fewer commercial farms, increased need for rural relief on so-

called subsistence farms, and much uprooting of rural people from the soil. The situation would not be so serious if we could look forward to a great industrial revival, and to the progressive absorption of manpower released from commercial agriculture. As yet, however, the revival is only partial. In fact, if the agricultural income slumps, and farmers reduce their buying of factory goods, the cities may send people flocking to the farms. Hence the danger of failing in the agricultural program is less than the danger that would result from dropping it.

OLD AND NEW PROPOSALS FOR FARM RELIEF

Ideas and devices set forth in the Agricultural Adjustment Act of 1938 can generally be traced back to suggestions for agricultural legislation and other agitation for farm relief that developed after the war. To understand how completely it covers the field of agricultural adjustment and policy we need to review the proposals for agricultural relief that have been advanced during the last two decades. Farmers interested themselves long ago in farm improvement legislation, notably from the 1870's to the 1890's in the Granger and Populist movements. But the post-war period faced them with an entirely new situation out of which a new farm philosophy arose.

Farm-relief agitation in the early 1920's centered around the following general ideas:

(1) Equality for agriculture and a fair share of the national income;
(2) The related idea of security for the farmer against bankrupt or bargain-counter prices and against crop failure, mortgage foreclosure, and insecurity of tenure;
(3) Balanced farming and efficient production. This idea was a carry-over from the general farm philosophy of the previous half century;
(4) The need for marketing and credit reform;
(5) The demand for higher customs duties on farm products;
(6) Various proposals for lifting domestic above world prices through the stimulation of exports or in other ways;
(7) Price stabilization;
(8) Soil conservation.

Conditions in the 1920's brought farmers into agreement as to the need for action. The marketing system with its high middlemen charges was a sore spot. Farmers believed cooperative associations would reduce the costs and wastes involved and strengthen their bargaining power. They hoped by the same means to raise the prices of agricultural products, to promote orderly marketing, and to keep production more in line with the demand. Congress had long been sympathetic to agricultural cooperation. It passed the Capper-Volstead Act, the Cooperative Marketing Act of 1922, and other legislation to aid the cooperatives. The cooperative movement brought many improvements such as standardized production, commodity grading and branding, and more efficient marketing. But it sometimes benefited nonmembers more than members. It could not solve the more acute surplus problems.

There was some demand for higher customs duties on farm products. Agriculture had long resented the greater degree of protection accorded industry by the tariff. In 1922 Congress passed the Fordney-McCumber Tariff Act, and in 1930 the Smoot-Hawley Act. But the higher duties did not and could not remedy the situation. Import duties do not increase the domestic prices of commodities sold largely in the world market, such as cotton, wheat, tobacco, and pork products. Neither do import duties solve for long the problem that confronts farmers who produce products on an import basis. Sooner or later the production rises and the internal competition between American farmers becomes fully as serious as foreign competition. Oftentimes production is stimulated to a point where the tariff wall becomes useless because the product is on the export market and must sell for the world price less ocean freight. Tariffs therefore can never be a long-time solution of an economic problem. Indeed, the post-war tariff revisions upward did harm to agriculture. They excluded imports that would have paid for exports. Agriculture needs some tariff protection, but the advantage disappears if the duties on nonfarm imports are virtually prohibitive. No imports mean no exports.

Price Disparities Generate Various Plans

Price disparities against agriculture brought a demand for action to raise farm prices, with fair exchange value as the general objective. Many plans cropped up between 1923 and 1929, among them the McNary-Haugen plan, the export-debenture plan, and the domestic-allotment plan. The first McNary-Haugen bill of 1924 and the vetoed McNary-Haugen bills of 1927 and 1928 embodied the equalization fee. Essentially the idea was that the farmers through Government agencies should segregate their export surpluses so as to raise prices at home. Losses to the Government were to be recouped from the farmers in equalization fees. The discussion of the McNary-Haugen plan laid a foundation for the first Agricultural Adjustment Act, which levied processing taxes to give farmers higher returns on their production for domestic consumption than on their production for export.

Similar in principle was the export-debenture plan, which Congress considered in the McKinley-Adkins bill of 1926, and in the Jones-Ketcham bill of 1928. These bills, however, provided for the use of tariff revenues to subsidize exports. The Jones-Ketcham bill fixed the bounties on most commodities at one-half their respective tariff rates. One of the early versions of the domestic allotment plan provided that farmers should receive certificates permitting them to sell part of their crop (their domestic allotment) in the domestic market. The certificates or rights were to be sold to processors. On their production above the domestic allotment farmers were to receive only the prices obtainable in the world market. Other versions of the domestic-allotment plan called for benefit payments, processing taxes, and limitation of output. They took form in the Hope-Norbeck bills of 1932 and in the Agricultural Adjustment Act of 1933. Subsequent

versions of the domestic-allotment plan have contemplated unrestricted production and marketing with payments out of the Treasury on the products consumed domestically. The present farm program, with its acreage allotments, is still another variation of the idea; but the processing-tax mechanism which was destroyed by the Supreme Court in 1936 is lacking.

Limited Scope for Export Dumping

Agitation continues for the diversion of basic agricultural commodities into foreign trade under some two-price system. On minor crops and to a certain extent on such a major crop as wheat this method has limited application in the present program. Export diversion and the two-price system on a large scale would involve the abandonment of our present integrated method of acreage allotment, soil conservation, marketing quotas, and price-adjustment payments. Ten or fifteen years ago the plan might have worked temporarily. The thought then was that an inexhaustible and complacent foreign market would allow goods to be dumped on it indefinitely. There is no basis for entertaining that thought now. With world markets narrowed and world competition increased, and with deficit countries moving toward agricultural self-sufficiency, unlimited dumping is impossible.

Plans that called immediately for greatly increased agricultural exports could not succeed. Importing countries would raise their tariffs or would exclude unwanted supplies through quotas and embargoes. World prices would fall. Prices in the United States would have to be fixed at high levels so that the farmers could break even. There would be loud protests from the consumers. Unlimited export dumping, with losses charged to the domestic consumer, is simply not practicable. If tried as a complete substitute for the present farm program, the results within a year or two would be disastrous both for agriculture and the other groups in the Nation whose welfare is bound up with that of agriculture. It is better to stimulate consumption domestically through whatever workable means can be found and in the foreign market through policies that will not cause importing countries to shut our products out.

Subsidy plans should be studied with regard to their cost as well as with regard to their ultimate effects on agriculture. Some current plans, such as those that would guarantee payments equal to the difference between actual and parity prices on the domestically consumed portion of the crops and leave acreage expansion unchecked, would ultimately collapse from the excessive cost. Inevitably, moreover, the large payments would lead to increased production and lower world prices, and it would be necessary progressively to increase the subsidy. Even so, much of the subsidized surplus might pile up in carry-overs, particularly if foreign countries regulated their imports by quotas. This resulting waste of crops and soil fertility would continue until the expense became prohibitive, or the growing surplus menaced our whole business and price structure.

Two Theories of Price Stabilization

There are two theories of price stabilization. One view is that it should work with factors that affect or determine prices, such as the supply of commodities, the rate of marketing, tariffs, and advertising, and let prices set themselves. Another view, in some quarters the more popular one, is that stabilization operations should fix prices outright, and not bother about the ordinary price determinants. Among the most frequently proposed criteria are those of tariff equivalence, parity price, parity income, and cost of production. The tariff-equivalence criterion has considerable justification; but it assumes that industrial tariff rates, which are almost purely arbitrary, are real measures of the disparity between the positions of agriculture and industry. Therefore it is unsatisfactory.

Parity prices and parity income constitute a more justifiable norm. They give us a rough measure of the gap that must be closed if agriculture is to receive its fair share of the national income. But we cannot apply these criteria rigorously and uncritically, particularly in establishing commodity-loan rates and parity or price-adjustment payments. We can calculate parity price but it may not be always a safe guide. Over a long period the prices of agricultural products do not necessarily bear the same relations to one another and to the general price level that they did in the base period. Furthermore, parity prices for some commodities may be inconsistent with the attainment of other important goals, such as normal consumption of farm products. Indeed, such prices may even be inconsistent with the attainment of parity income for the farmers.

Parity income better expresses the idea of equality between agriculture and industry, but it is quite difficult to measure precisely. Estimates of income from farming that goes to nonagricultural groups, of nonagricultural income earned by farmers, of the value of farm products consumed on the farm, and of other income factors can only be very rough.

The Cost of Production Criterion

In the minds of many people the plea for cost of production has a tremendous appeal. It looks synonymous with fair return. But the idea that cost alone can be used for price fixing or tariff making, either in agriculture or industry, is dubious. Almost insuperable difficulties prevent the accurate determination of costs on 6 million farms. Moreover, the enforcement of prices based on reputed costs would require a vast amount of governmental regulation, licensing, and regimentation of both farmers and middlemen. Cost of production is a false criterion over any long period. The true guide to prices that can be maintained is the concept of economic balance. Prices of both farm and nonfarm goods should be set at levels that will encourage both maximum consumption and maximum production. The formula must keep the economic organism functioning with the least possible disturbance. We must not forget the funda-

mental danger in price-fixing without corresponding control of supply. Almost inevitably the statistical procedure involved, as well as group pressures, will cause the price level to be fixed high enough to stimulate excessive production.

Present Program Offers Better Approach

Our present many-sided agricultural program offers a better prospect. It provides a rational approach to conservation and good farming. Acreages of the major depleting and conserving crops, and desirable soil-building and conserving practices, can be distributed geographically so as to combine conservation with efficient farming and bring about balanced production. With acreages of the major crops kept within individual, county, State, and national allotments and goals, farmers have an assurance in years of ordinary weather of production in line with market requirements. If yields are above the average, they can take a second step under the act. They can store their crops and get a commodity loan on them from the Government. If, in spite of these measures, the granary overflows, they can take a third step and vote marketing quotas on themselves and bring supplies in line with normal requirements. Conversely, the act through its ever-normal-granary feature avoids scarcity in years of drought.

Each of these steps is in the true spirit of self-government by the farmers. The first two are completely voluntary, in that the individual farmer can choose whether to come into the soil conservation program or stay out, and can choose whether or not to put his corn, wheat, or cotton in storage and take a Government loan. The third step, the use of marketing quotas, is an emergency step. It will not be taken unless two-thirds of the producers concerned vote for it in a referendum.

Under this act, at a time when factory production and pay rolls have been cut by a third and a recurrence of serious depression has been temporarily threatened, farm cash income has been sustained at a level only 12 percent less than a year ago. Income this year will be around $7,500,000,000 compared with $8,600,000,000 a year ago. Undoubtedly the stability in farm income has been an important factor in keeping business in general from going into a downward spiral similar to that which followed 1929.

Of the major commodities affected by the act, acreage programs have been in effect this year for corn, cotton, and tobacco. In the cases of the two latter, marketing quotas also have been employed following a favorable vote of the producers in a referendum. In each of these three commodities, production was kept approximately in line with demand and surpluses were not increased. However, carry-overs still are large because of the excessive production of 1937, when agriculture seriously felt the lack of the measures which had been struck down by the Supreme Court in 1936. In the case of wheat, the act is just now going into effect. The existing carry-over of wheat has resulted from the big acreage planted for harvest in 1937 and

1938, while wheat farmers were still suffering from the lack of the adjustment machinery destroyed by the Supreme Court's decision.

The results thus far in 1938 clearly demonstrate that the act is well-conceived and with possible further refinement and improvement can be enormously useful to farmers and the general public. It gives us most of the authority we are likely to need in building a sound farm program. Further legislation may be required on certain details but the general approach to the problem of farm relief need not and should not be radically changed.

Promotion of Exports

For the promotion of our agricultural export trade the measure authorizes the use of funds derived from customs duties. Our reciprocal trade agreements program offers the most hope in this direction. But in periods of emergency, such as now exist with respect to wheat, it may be necessary temporarily to adopt limited export-subsidy measures in order to retain our fair share of the world market. If all nations used export-subsidy measures simultaneously as a general policy, these measures would be mutually self-defeating. They would mean international price cutting. Price wars in international trade are as disastrous as in private business. There is urgent need for an international understanding on the matter. Meantime, until the situation improves, we must take steps to keep our place in the world market and to expand the market for our farm products. Our Government is doing what it can to persuade other wheat-exporting nations to join in what might be called an international ever-normal-granary plan; in a plan to stabilize the amounts of wheat offered on the world markets by each nation year after year.

Domestic Two-Price Arrangements

One feature of the program which probably should be given greater emphasis in the future is the distribution of surpluses to low-income groups that are undernourished. This is not a sudden new idea. The Department has cooperated for several years with relief agencies in distributing free supplies of food to the destitute. Some of the marketing agreements have provided for the partial disposal at low prices of surpluses in ways that do not interfere with distribution through regular channels. This feature of our program could be expanded.

Consumer demand in the low-income groups is potentially elastic for many products, and even for staples like wheat and cotton. If these groups had facilities for buying certain foods at lower retail prices, they would buy more than they do now. The plan would also increase the income of the farmers. For example, many families with low incomes buy no fresh milk and no citrus fruits. They contribute nothing to the income of the dairy farmer or citrus fruit grower. Some two-price arrangement by which low-income groups of consumers could buy surpluses at low prices while the rest of the

population paid the regular market price would provide farm relief and consumer relief.

This approach to farm relief and consumer relief has recently been much discussed. There are many practical difficulties. The benefit of the lower prices should go to the consumers most in need of it especially the needy children. It is important that the distribution should be accomplished with the cooperation of processors and distributors, rather than in competition with them, in a manner that will not disrupt the existing marketing organizations; moreover, it should be done at the lowest possible cost. These are difficult problems. The Department is not yet ready to undertake any extensive program of this kind, or one applied to all farm products in all parts of the country. It intends, however, to see what can be done in a small way under our present farm act.

In considering how the proposal may help farmers, we should remember that agriculture's surplus problem is not of its own making. Expansion during the World War left it with surplus capacity; our change to the creditor position reduced farm exports; our high postwar tariffs provoked retaliation and added to the export disability; new farm competition developed in Brazil, Argentina, Australia, and elsewhere; Europe struggled toward agricultural self-sufficiency; and many American industries maintained high inflexible prices out of line with farm prices. Then came the depression, which reduced the buying power of American consumers. These troubles of nonagricultural origin entitle agriculture to look outside itself for help in dealing with the surpluses.

If all our people could be quickly reemployed at good wages, we should not need any two-price plan; consumption would expand automatically. Indeed the only permanent way to increase agricultural consumption is to create new buying power through increased production of nonfarm goods. But millions are unemployed; other millions get low wages; consequently, agriculture and industry stay out of balance. Agriculture produces abundantly, while industry with frequent lay-offs produces only what the market can absorb. Surplus farm capacity results in stocks of goods while surplus industrial capacity shows up chiefly in idle labor.

This is a painful anomaly. The consumption of industrial products potentially is almost limitless; food consumption runs up against the limitations of the human stomach. It is absurd to produce an insufficiency of desired things and simultaneously a great surplus of things already superabundant. But the anomaly persists. With Europe upset, we cannot export large surpluses on a basis that will pay for the labor and soil fertility in them. The best solution would be to work out the city problem but we do not yet know how to reanimate our urban industries. Therefore, we must resort to special means of getting crops consumed domestically. Our people will not indefinitely tolerate scarcity amid abundance, and in years of large crops both farmers and consumers will want the surpluses made available to the needy.

Only Three Courses Open

There are only three principal ways of dealing with farm surpluses. One is to stop producing them, and to divert agricultural land and labor wholesale to other ends. Another is to store the surpluses, in the hope of marketing them eventually. The third is to adjust farm production moderately, through means that keep farm land and farm people employed, and to deal meantime in special ways with surpluses that accumulate unavoidably. The third way is the only practical way; it is the way we have followed through various expedients for several years. Inevitably, in one form or another, it involves price differentials. Surpluses that remain after the ordinary market has taken what it wants bring lower prices. It is preferable to give our own people rather than foreigners the benefit of such bargain prices. Surplus disposal at home cannot entirely supplant surplus disposal abroad; prevailing conditions oblige us to offer some crops in foreign markets at low prices, with partial compensation to growers through price-adjustment payments. But we can tap new levels of demand at home as well.

Mainly the surplus problem appears in the great staple crops; but it appears also in fruits and vegetables and in livestock products such as meat, eggs, and milk. Milk has been sold in New York City at a reduced price to low-income groups. Some similar plan might be worth while for some other farm products. For example, the grapefruit crop this year may be 40 million boxes or more. The maximum commercial use is only about 29 million boxes. Grapefruit of the No. 1 and No. 2 grades will fully supply the ordinary market. All of the No. 3's and culls and a part of the better grades will go to waste unless something unusual is done; but growers will have no choice if the market is too low to pay freight and handling charges. All interested groups should cooperate to get the extra grapefruit consumed. Perhaps if the farmers are willing to sell them at a sacrifice, the railroads will ship them at less than the usual rate and handlers and retailers will reduce their charges. Then the surplus grapefruit can be offered to low-income groups at low prices.

This is just one illustration of the problem. Possibly ways can be found for moving staple as well as special crops into increased consumption among low-income groups. We ought to seek out new methods of supplying these groups, partly through the reduction of distribution costs and partly through special prices. Surplus disposal at low prices to low-income groups need not mean price raising to other consuming groups. On the contrary, farm income from goods that might otherwise be wasted may allow of sales at lower prices in the ordinary market. It is a question of balance. Up to a certain point the disposal of surpluses at low prices, among groups that would otherwise not be in the market, makes a net addition to the farm income, and lessens the urge to demand higher prices in the usual channels of trade.

An interesting variation of the ever-normal-granary idea is now in effect for dairy products. Through the Commodity Credit Corporation, funds have been advanced to a new agency, the Dairy Products Marketing Association, Inc., for the purchase of butter during the season of flush production. The plan is, if possible, to sell the butter during the season when production normally diminishes. However, in case market conditions do not permit the butter to be sold at a price that will cover all costs, the Federal Surplus Commodities Corporation will be authorized to buy it from the Dairy Products Marketing Association and distribute it to families of the needy. Through this plan combined with the plan for stabilization of dairy-feed supplies, it should be possible to give butter prices more stability and dairy producers higher average returns than they would otherwise receive.

Other features of the present national farm program provide for marketing agreements, crop insurance, tenant-purchase operations, rehabilitation loans, submarginal-land retirement, and development of new and expanded uses for agricultural products through research. In the main our task is no longer to hunt for new ideas; the principal lines of the program are set. The task is to perfect what we have and to improve its administration. For this we shall need the full cooperation and support of all groups, and particularly of the farmers themselves. Farmers must have an intelligent understanding of what the program means and how it works. Then they will give it their wholehearted sympathy and support. In the soil conservation and ever-normal-granary phase of the program, the job is essentially one for the farmers to do themselves. It is they who suffer most when surpluses pile up; it is they who must keep the surpluses down, and at the same time use the ever-normal-granary principle as a safeguard against shortage.

The Problem of Financing

There is a problem of financing. Although the Agricultural Adjustment Act of 1938 allowed for parity payments, it provided no continuing source of revenue for this purpose. Farmers cannot yet be certain that the parity principle established by Congress will be maintained. They will not be certain until some arrangement is made whereby the particular commodity concerned bears at least a part of the cost of financing its own program. Then, and only then, will a continuing source of revenue be assured. Under the early agricultural adjustment programs a processing tax on the basic commodities provided necessary revenue for 2½ years. Cooperating farmers had the assurance of the equivalent of parity prices on the domestic consumption of their products. They got part of their price from the market place and the rest from the Government in benefit payments. The program was self-financing and helped to balance the budget. Why should not this kind of tax be used again to finance the parity payments—at least for the export commodities, wheat and cotton—for which the new act provides? Such a tax is one important thing

missing from our present farm program. It would help maintain balanced production and surplus control by assuring a continuing source of revenue to finance a portion of the program. It would help maintain parity of income by assuring a continuing source of revenue for parity payments on the commodities that do not lend themselves to price boosting through adjustment of supply.

LAW PROMOTES ABUNDANCE AND DEMOCRACY

In a democracy such as ours economic legislation must promote certain noneconomic ends. Besides encouraging the production of wealth, it must maintain the freedom of the individual and of the community. The object cannot be exclusively material.

Man needs both bread and freedom; it is a calamity when he must barter one for the other, and the result may be the break-down of civilization. To promote abundance, both material and spiritual, at the same time and by the same means is not easy. Increased production calls for economic and social organization, with increasing interdependence and cooperation among different economic groups. How can we achieve this and at the same time preserve freedom and democracy?

This is a complex and delicate task, which depends for its accomplishment on a blend of physical and economic science with social justice. It requires, moreover, the support of public opinion. Everything done must enlist the informed and willing cooperation of the Nation as a whole; otherwise it will not be truly democratic. Efficient social cooperation without coercion is the formula, which may not be abandoned on pain of grave social disturbance.

In the Agricultural Adjustment Act of 1938 we have an important instrument for promoting the twofold objective. On the economic side the law expresses the unity of interest among different groups in agriculture and safeguards the consumer through provisions for the maintenance of a continuous and stable supply of agricultural commodities at fair prices. On the social side it applies the principle of democracy. It is a new charter of economic and political freedom for both producer and consumer. Abundance and democracy are the twin foundations. Few people doubt that, as we may infer from the majorities which the measure received in Congress, and also from the general support it obtained throughout the country. Nevertheless, both before and after the enactment of the measure, it came under a certain amount of fire.

No True Freedom Without Abundance

There is still some feeling that the law may promote scarcity and not abundance and regimentation as distinguished from democracy. A minority refuses to believe it will promote both abundance and democracy. Unless it does the Nation will condemn it. There can be no true freedom without abundance and no satisfying abundance without freedom. There must be widespread understanding and approval of the principles involved; otherwise programs really demo-

cratic in conception will not have the necessary public support and will have to be dropped or modified. Moreover, the support required is urban as well as rural.

The present farm act, like its predecessor of 1933, provides in certain circumstances for the limitation of farm production. With respect to corn, wheat, cotton, tobacco, and rice it authorizes the establishment of national acreage allotments divided up among the farmers. These allotments contemplate production sufficient for the domestic and export markets, and for the provision of above-average carryovers. Also, the measure authorizes marketing quotas for use when the granaries overflow as a means of supporting prices. The quotas regulate the movement of crops to market. Superficially, these regulations may seem opposed to the idea of abundance. Actually, they promote it by smoothing out the fluctuations of supply and price from year to year. Controlled stable production means more production in the long run than would result from uncontrolled mass swings from high to low production.

Agriculture needs crop adjustment to prevent these mass swings, which lead to recurring cycles of underproduction and overproduction. Consumers need it, too, because widely fluctuating production, with its inevitable addition to the farmers' costs, means higher consumer prices in the end. For example, the farm price of corn ranged from 10 cents a bushel in 1932 to more than $1 a bushel in August 1937. Soon afterward it dropped to 40 cents. These price changes followed production changes. Consumers of animal products suffered with the producers. Very low prices at the farm did not mean proportionately low prices in the city, yet high farm prices had a quick reflection, with certain additions, in the retail markets. Uneven production injured both producer and consumer.

In September 1937 the price of well-finished kosher beef climbed to 40 cents a pound in New York City, and a retailers' meat strike resulted. There was no permanent advantage in that to anyone. With the supply of meat more regular from year to year, on a basis of more regular feed-crop supplies, there will be more abundance in the town and more income in the country. Yet retail prices may average lower. There is no need to multiply illustrations. Consumers need protection against excessively high prices, while producers need it against excessively low prices. The groups have a common interest.

Even with the crops produced heavily for export, abundance calls for stable rather than for wildly fluctuating production. True, the domestic consumer will not go short. Our cotton and wheat crops are far above domestic wants. It would be wrong, however, for the consumer to imagine that the largest possible production of these crops means the greatest benefit to himself. With wheat or cotton production vastly in excess of the foreign and domestic demand, agricultural depression occurs and injures the urban centers. Consumers do not profit from 5-cent cotton or 30-cent wheat. Such prices reduce the retail cost of shirts or bread very little, yet they mean widespread agricultural distress, with consequent reduced agricultural buying in the cities. The fractional advantage to the consumer disappears in the associated damage to urban trade.

Aim is Permanent Abundance

The ever-normal-granary features of the A. A. A. aim at permanent abundance. They provide, with normal yields, for supply levels of cotton, wheat, corn, tobacco, and rice at above-normal percentages sufficient to cover the usual domestic and export requirements and to build up enlarged carry-overs. In wheat and corn the carry-overs on the average will be much larger. Shifts to soil-conserving crops will improve the land and develop a production-power reserve for emergencies. Crop insurance for wheat will give farmers better protection against crop failure and consumers better protection against high prices; for the premiums will be wheat, which will add to the ever-normal-granary supply. Moreover, the community has protection against artificial shortage. Marketing quotas can be proclaimed only when supplies reach high levels, and commodity loans will be available to the farmers only when accumulating stocks threaten them with price collapse. There is no loophole for improper storage as a means of extortion. All phases of the act look toward stable, abundant production and fair prices.

Farm production that is very uneven involves high costs. No one knows the waste involved, and the injury to agricultural capital and labor, in the swings from high to low. And the consumer bears his share. In fact, the resulting mark-up in prices is loss all round; it adds nothing to the farm income and mulcts the consumer unnecessarily. Effort thrown spasmodically into production, only to be as suddenly withdrawn, is wasteful. It means excessive overhead for the occasional peak load, and heavy loss periodically in the forced liquidation of flocks and herds. Uneven production wastes the soil too. In the Great Plains we purchased high production of cereals for a few years at a terrific price in soil destruction.

Stable production means more production in the end. Specialists in farm management observed long ago that the hog producer who keeps his output relatively stable from year to year and avoids the fluctuations of the 4-year cycle earns more on the average than the man who rushes in and out of the business erratically. Relatively stable production evens out profits and losses quickly and prevents extremes. Because it is efficient and economical it is ultimately greater in volume. What applies to the individual hog producer applies also to the different branches of agriculture and indeed to the entire agricultural industry. Controlled production means abundance more of the time, since it helps to obviate the alternations of glut and shortage.

Agriculture Aids Urban Production

Stable production in agriculture means more production in urban industry likewise. For one thing, it meshes better with the rest of the economic system. Stable production in agriculture is an important contribution to stability in the whole economy. Activity in many urban businesses, particularly in those that depend directly

on agriculture for supplies, varies directly with the production of agriculture. For example, railroads, elevator companies, ginners, exporters, and other handlers of farm commodities get more out of big crops than out of small. Widely fluctuating farm production, however, obliges them to maintain a plant sufficient to carry the peak loads, and this means heavy overhead. Gain to agriculture through stability is gain to them, and gives them ultimately a larger and more profitable business.

Industries for which agriculture is primarily a market, rather than a source of supplies, find themselves in a different position. They depend on agriculture's buying power. Ordinarily, when farm production soars farm income drops; whereupon sales of agricultural implements, fertilizer, farm building materials, farm furnishings, and other goods decline. This type of urban industry, equally with the type that looks to agriculture as a source of supplies, stands to benefit from a better regulation of farm production and a more even level of farm income. Gains and economies effected in agriculture through regulated production tend to be reflected throughout the industrial system, which has increased and more uniform activity.

There is a saving to industry both in capital investment, which need not be so large for the occasional boom, and in labor. Frequent and extreme changes in the employment of labor are notoriously wasteful. They increase the labor turn-over and diminish the individual efficiency. Moreover, lay-offs crowd the relief rolls and burden industry with taxes. Farming and industry, including mining, comprise the base for practically the whole economic system. Each carries a superstructure of financial, technical, scientific, and legal institutions, but the taproots are fairly concentrated. Hence, increasing stability in the agricultural half of the system means increasing stability in the other, and ultimately greater production. When the historian describes this epoch, he may report that it largely bridged the gap between scarcity and abundance, through the use of the ever-normal granary in agriculture and the resulting evening out of the business cycle.

Economic Planning and Democracy

Acknowledging that the Agricultural Adjustment Act truly promotes abundance and not scarcity, we come now to its methods. Are they compatible with our democracy? They introduce governmental planning into matters formerly not subject to governmental guidance, and place the power of the Government behind the necessary action programs. Opponents call this regimentation; they say it is not consistent with our traditions and principles. Manifestly, however, this begs the question, because it assumes that the scope of democracy has long since been established once for all. It sets up mere custom as the arbiter. In a constantly changing and evolving economic and social environment, the basic political principle must be capable of change and development likewise, or it will die and give place to something with life in it. We cannot condemn the

farm legislation in terms of democracy merely on the ground that it is an innovation; many things in our economic and political system, things that no one dreams of calling undemocratic nowadays, were innovations not so long ago. Among the familiar examples are the Federal income tax, the Federal Reserve System, Federal regulation of the railroads, regulation of public utilities, meat inspection, and Federal food and drug legislation. Nor can we say that the democratic principle should not apply to economic matters. There are too many accepted instances to the contrary, from the tariff to urban zoning and market supervision.

Every American has his own definition of democracy, and the definitions vary widely. There is a mistaken view that it means freedom for every man to do just as he likes with his property, regardless of how his actions may affect the general welfare. In countless instances the courts have said he may not. Every democratic right has its limitations, even the right of free speech, which may not be blasphemous, seditious, or defamatory. Another obviously mistaken view is that democracy enjoins public agencies from doing anything that might conceivably be left to private initiative, and frowns on public enterprises like mail distribution, education, forestry, waterworks, irrigation, drainage, crop reporting, and road building. Democracy is not just laissez faire; it includes the protection and the constructive advancement of public as well as of private interests. In proof we may note the progress of democracy in this and other countries side by side with a great extension of public works and services. We cannot define democracy in negative terms, and make of it a mere system of prohibitions. It is a positive doctrine that authorizes positive programs with regard to any issue of pressing national concern. Not to admit that is to condemn democracy to impotence.

Safeguards of Democracy in Farm Act

In the Agricultural Adjustment Act the first safeguard of democracy is the authority of Congress, which enacted and may amend or repeal the measure. The second is the injunction to use democratic processes in working out and administering the farm programs. Our farmers have been experimenting with economic democracy for the last 5 years; they began in 1933 under the original Agricultural Adjustment Act. Subsequently, under the Soil Conservation and Domestic Allotment Act, they elected committees in 25,000 agricultural communities. These community committees assist the county committee, cooperate with county agents and with State and Federal officials in working out desirable changes in cropping systems, and actually administer local aspects of the crop adjustment and soil conservation work. This system continues under the new law. County committeemen supervise the programs, hold discussion meetings, inquire into complaints, transmit recommendations from farmers to the State committees, check the compliance with requirements, and acquaint farmers with the world facts and conditions that determine agricul-

tural policy. Such methods enable millions of farmers to understand and influence the programs.

When the granaries fill, farmers themselves decide through democratic processes whether marketing quotas enforced by penalties shall go into effect. Under the first Agricultural Adjustment Act the A. A. A. applied this principle as a matter of administrative discretion. Now the principle has the specific mandate of Congress. Not just a simple majority of the interested producers, but a favorable vote by a two-thirds majority of the votes cast, is necessary before the quota provision can be set in motion. Moreover, the principle can be invoked only when substantial surpluses exist. This requirement has a twofold justification. It prevents the coercion of large minorities, and tends to delay the resort to the quota principle. Obviously, since production costs vary from farm to farm, prices must usually drop very low before two-thirds of the farmers will want to store their crops. As the prices rise, the proportion of the farmers who can get by will increase, and with it the reluctance to use quotas. Hence, the two-thirds rule protects both the consumer and the farmer from hasty or ill-considered action.

Some might insist that nonfarmers as well as farmers should be entitled to vote on proposals for marketing restrictions, since the decision may affect prices. This would be true were the restrictions likely to create shortages. They can never do that. The national crop goals provide for abundance. They call for the production of plenty for domestic requirements and for export trade and carry-overs as well. Not until the granaries overflow may farmers invoke the quota principle for the limitation of excessive marketing supplies. Only as a last resort, through a two-thirds majority vote, may the farmers claim this protection. There is no consumer interest in jeopardy or even in question. As a matter of fact, the situations in which the quota principle may be invoked give the consumer a temporary advantage. Farmers cannot injure consumers by utilizing the marketing-control sections of the Agricultural Adjustment Act, though conceivably they may injure consumers by not doing so. As already indicated, consumers as well as farmers have an interest in the control of the surpluses. It is entirely democratic to take marketing referenda among farmers only, because the situation itself as well as the enabling legislation amply protects the consumer.

Democracy the Heart of Science and Invention

Another issue connected with the farm law in its relation to democracy goes deeper. Some critics admit that the law may promote abundance, and that it utilizes democratic processes. They contend, however, that the final result will be antidemocratic, because it will involve the growing intervention of the Government in economic life. Extension of governmental power over economic matters they regard as synonymous with the growth of regimentation and dictatorship. This is a very serious charge. If it could be proved, it would warrant our dropping the whole agricultural program, and letting agriculture

go back to unrestricted individual competition, with whatever penalties that may involve in wildly fluctuating prices and recurrent overproduction. Indeed, it is essential to preserve democracy even for material reasons. It is the heart of science and invention, and it is therefore a great economic power. Modern productivity is largely the result of it and of the mental freedom it implies, and the decay of democracy would be followed eventually by a decline in material well-being. Economic planning through public agencies must promote democracy as well as production or we cannot afford it.

Fortunately, economic planning is wholly compatible with democracy, and widens the scope of it. There is no need to dread it as a cause of dictatorship. It may or may not accompany dictatorship. There is no cause-and-effect relationship. Numerous dictatorships in the past have done little economic planning, while many democratic nations have done much. Quite other things are the real essence of dictatorship. Among them are the censorship of speech and of the press, the subjection of science and learning to the Government, the destruction of parliaments and of independent political parties and trade unions, and the concentration of authority in a single individual or in a small group. Often there is another sinister development—the mobilization of men and of industry for aggression. Nations thus controlled inevitably do considerable economic planning, but this is not their vital characteristic. What is vital in them is the substitution of a concentrated for a diffused political power.

This concentration of political power, with the consequent destruction of individual liberty, is quite different from the purely administrative centralization of various governmental tasks. It is important to keep the distinction well in mind. Concentration of political power means the total extinction of the voter's rights, whereas mere administrative centralization leaves the rights of the voter unimpaired. It is the concentration of law making rather than of law administration, and of policy rather than of procedure, that distinguishes the totalitarian from the democratic governments. Efficiency obliges all governments to centralize many administrative operations, such as defense, diplomacy, customs collections, mail distribution, and the regulation of transport and communications. As long as the deciding voice with regard to policy in these matters rests with the voter, the administrative function remains the servant of the legislative power, which in turn is the reflection of the national will. In a democracy political power belongs to the voters, and the popular sovereignty can delegate administrative jobs to control agencies without the slightest danger to itself. Responsible people never contend, for example, that Federal road construction, Federal control of the traffic in food and drugs, or Federal supervision of the great commodity markets is inconsistent with democracy in the United States.

Planning in European Democracies

The intervention of governments in economic matters is common in the European democracies. Visitors from Great Britain, France, Belgium, the Netherlands, and the Scandanavian countries find nothing new or startling in the American programs for agricultural adjustment, social security, trade-union recognition, and economic regulation generally. They find us backward in these respects. Many countries, including notably Great Britain and the British colonies, have experimented with and adopted devices strikingly similar to those of the New Deal. Every important feature of our agricultural program has its counterpart in Great Britain, France, the Netherlands, and the Scandanavian countries. These Nations have found extensive economic planning entirely compatible with political and economic democracy. There is no reason to doubt that the experience of the United States will be the same.

In fact the United States, with its long tradition of individual freedom and its lively consciousness of the material progress that results from liberty in science and invention, may develop improved methods for harmonizing economic planning with democracy. Here the problem is relatively simple. There is no imperialistic urge to complicate it, and no constant threat from uneasy neighbors. Here the effective drives toward dictatorship are lacking. We have no revolution to suppress, no territories to reclaim, no shortage of resources to offset by conquest, and no foreign threat to our domestic security. In the rise of dictatorships abroad, we can see the influence of all these forces. Our exemption from them is an ample guaranty that the economic readjustments we have to make can be achieved through concerted action and with governmental help at no sacrifice whatever of our democracy. Many people flaunt the bogy of dictatorship irresponsibly, while others fail to distinguish what is unique in dictatorship from what may be an element also in democratic governments. Our situation gives us every hope that we can strengthen our democracy while applying it to economic problems.

In times like these economic planning is the savior rather than the destroyer of democracy. It substitutes order for chaos, and appeasement for disaffection. In this way it averts dictatorship, which indeed cannot arise until orderly government has broken down and the masses are in revolt. Ancient and modern history testify to that. With unemployment unrelieved, and with agriculture in ruins, we should be in real danger of dictatorship. There would be bread riots in the cities and mortgage strikes in the country; it would be impossible to maintain order without the use of force. From that point to dictatorship the descent would be swift. Instead, we have domestic peace, increasing economic justice, and firm reliance on government by discussion. All this has come about through employment relief, agricultural adjustment, and enlightened social legislation—in short through precisely the instrumentalities that some people take to be the germs of totalitarianism. Confusion as to the true sequence of events indicates a willful blindness. Perhaps

those who object to economic planning dislike what it costs them, and call it dictatorship because they want to hide their real objection. Impartial minds will clearly distinguish the remedy from the disease, and will regard it as a sign of health and vigor in our democracy when it deals efficiently with our economic maladjustments.

Applications of Science Through Democratic Procedures

As we look back over the last few centuries, we can trace a large part of our economic progress to science, and that means to freedom and democracy; for there is no science without freedom. Science must be free to investigate everything, the problems of ethics, politics, religion, and philosophy, as well as the practical affairs of industry and agriculture. Otherwise it cannot advance broadly; the practical applications suffer along with the so-called pure research. It is a commonplace that many important uses of science, particularly in chemistry and biology, began in studies that seemed at first to concern chiefly religion and philosophy. Science and democracy are correlatives; for it is impossible to make science free, which means to democratize it, without simultaneously emancipating other legitimate interests as well. Obviously, therefore, the natural home of science is the democratic society, which puts a premium rather than a penalty on the discovery and publication of knowledge. The present conflict between the powers of production and the limitations of the market need not change this relationship. It calls simply for new applications of science through democratic processes and Government agencies.

Our problem is to conserve the democracy that has given us our progress, while at the same time adapting it to the new conditions of which it is in part the cause. In short, we must control the economic powers our democracy has developed, and not let them become a Frankenstein. What the democracy produced it can manage, without going outside itself for the means, and without stultifying its own nature. That is not a mere assertion; it is an inference from the strong probability that progress and freedom are interdependent. It has yet to be proved that progress can continue anywhere without freedom for the individual to offer new proposals and to challenge established ways. Obviously, if progress and democracy go together, there is no question of preferring one to the other. It is both or neither. This condemns experimentation with undemocratic procedures. There is no point in controlling production by means that eventually may kill the production. The problem is to achieve by common consent whatever is necessary, with the springs of information running free and clear, with decisions arrived at through democratic processes, and with full freedom at all times for full discussion. This assumes that what is necessary is reasonable, and that whatever is decided by the electorate to be reasonable is democratic. It is a fair assumption.

THE A. A. A. PROGRAM FOR 1939

In most respects the A. A. A. program for 1939 is similar to that of 1938. The essential points are:

(1) Establishment of national allotments for soil-depleting crops and a national objective for soil-building crops and practices.

(2) Establishment of individual soil-depleting crop allotments for the following crops: Wheat; cotton; corn; rice; potatoes; flue-cured, burley, fire-cured and dark air-cured, cigar-filler and binder, and Georgia-Florida cigar-wrapper tobaccos.

(3) A maximum payment for each participating farm for keeping within soil-depleting crop allotments, for attaining soil-building goals, and for the carrying out of good farming practices.

(4) Crop classifications and soil-building practices similar to those approved in 1938.

(5) Provision that land used for home gardens may be excluded in calculating soil-depleting crops for the farm. This is a new provision, intended to raise the living standards of many farm families.

(6) Continued efforts to restore grass on land unsuited for crops in the Great Plains region.

The principal changes in the 1939 program as compared to the 1938 program were required by the acreage allotment and payment provisions of the Agricultural Adjustment Act of 1938.

As in 1938, the general soil-depleting crop goal and the special soil-depleting crop goals for wheat, corn, cotton, rice, and tobacco will be divided among States, counties, and individual farms. The acreage allotment for wheat for 1939 has been established at 55 million acres. It is being apportioned among the States, counties, and individual farms on the basis of the formula provided in the act. This allotment compares with the 10-year average of about 69 million acres and an acreage seeded for 1938 of more than 80 million acres. Wheat growers who comply with 1939 wheat-acreage allotments will qualify for 1939 conservation payments, price-adjustment payments, eligibility for loans on wheat, if a wheat-loan program is in effect next year, and renewal of crop insurance program policies.

Some Changes in Farm Allotments

The acreage allotment for cotton in 1939 will approximate the 27,500,000 acres allotted for 1938. There will be some change in the farm allotments. The acreage allotments for corn, tobacco, rice, and other commodities for which special allotments are to be made will not be decided until final reports are available on the 1938 production.

Under the 1938 program, payment was made in areas, known as A areas, for the diversion of acreage from general soil-depleting crops (crops which had no special allotments). The A area included all the north-central region, North Dakota, Kansas, Oklahoma, Texas, the eastern parts of Montana, Wyoming, Colorado, and New Mexico, northwest Arkansas, and a group of counties in California.

The area outside the A area was known as the B area, and payments with regard to the general crop acres were earned only by soil-building practices.

The changes in the B area for 1939 include:

In the northeast region a corn-acreage limit and vegetable-acreage limit equal to the acreage usually grown will be established in addition to special allotments. No payment will be made for diverting general soil-depleting crops, and total soil-depleting acreage allotments will not be established.

Outside that part of the A area in the southern region, general soil-depleting crop allotments will be determined only for those farms on which either feed crops or livestock products are grown for sale. In 1938, general soil-depleting crop allotments were established for farms in the southern region, but these allotments made allowance for all food and feed crops needed for home use. It is expected that this change will simplify the program.

Formula for Fund Apportionment

The Agricultural Adjustment Act of 1938 contains a definite formula for apportioning funds among the several commodities or groups of commodities and for calculating rates of payment. After determining the amount of funds apportioned to each commodity, the rate of payment is determined by dividing the amount of funds allocated to that commodity by the estimated acreage allotment times the normal yield of the commodity on the farms participating in the program.

Under this formula, the rate of payment with respect to commodities varies with the amount of diversion necessary for the commodity in order to reach the goal established under the program.

The rates of payment in connection with the 1939 A. A. A. program cannot yet be definitely determined because some of the information necessary in computing these rates, including final estimates of 1938 production, is not yet available. Sufficient information is available, however, to indicate, within a range, the probable rate of payment for each commodity.

The cotton, corn, wheat, and rice payments and possibly payments with respect to some kinds of tobacco will be made up of two parts, (1) payment from the appropriation under the Soil Conservation and Domestic Allotment Act, (2) a price-adjustment payment from the $212,000,000 appropriated in the Price Adjustment Act of 1938.

As in 1938, deductions from conservation payments are to be made for plantings in excess of depleting-crop allotments. Payments for soil building must be earned by carrying out soil-building practices.

Price-Adjustment Payments

The rates of the price-adjustment payments are to be determined in accordance with the method of allocation specified in the Price-Adjustment Act of 1938. This requires that one-half of the available

funds be divided among the commodities in the same proportion that such commodities share in the allocation of the conservation appropriation. The other half of the funds is to be allocated on the basis of the amount by which the returns from the 1938 crop are below parity income for the commodity. This determination is to be made for the period ending January 31, 1939. Therefore, the price-adjustment payments cannot be definitely determined until that date. In addition to the factors mentioned, these rates will depend on the extent of the 1939 participation in connection with each commodity since the adjustment payments can be made only to farmers who plant within their 1939 acreage allotments.

The restoration land program in the Great Plains States will be continued in 1939 on approximately the same basis as in 1938. In 1939, however, a deduction at the rate of $3 per acre will be made for each acre designated in 1938 or 1939 as restoration land which is plowed or tilled in 1939 for any purpose other than to protect the land from wind erosion or in preparation for the seeding of perennial grasses.

The deductions for the plowing up of native sod and failure to prevent wind and water erosion will be essentially the same in 1939 as in 1938.

To help meet the acute wind-erosion problem in the Southern Plains, the 1939 A. A. A. program will provide that soil conservation districts or associations organized under State law to carry on erosion-control programs will be eligible to receive payments as agricultural producers for all lands operated by them either as owners or tenants. This should enable the soil conservation districts and associations to acquire control over abandoned lands by leasing them from the absentee owners, and then to perform needed erosion-control work on the lands. Many of the districts and associations, however, may be unable to finance such work in the period prior to receipt of the A. A. A. payment. To meet this problem the Farm Security Administration is arranging to make loans to the districts in amounts up to 90 percent of the expected A. A. A. payments. The districts can then use the loans to stabilize lands that are subject to wind erosion, and thus contribute both to the rehabilitation of the people within the district, and to the conservation of its soil resources.

In counties subject to serious wind erosion in the southern Great Plains area at least 30 percent of the maximum payment for each farm is to be earned by carrying out soil-building practices. The purpose of this provision is to encourage further adoption of wind-erosion-control measures in this area.

In general, the soil-building practices approved for payment in 1939 will correspond to those approved in 1938. The range program will be continued in 1939 on about the same basis as in 1938.

The actual appropriation for the 1939 A. A. A. farm program has not been made except the $212,000,000 appropriation for price-adjustment payments. The 1939 program, therefore, is dependent on the

action of Congress. In 1936 Congress authorized an annual appropriation for carrying out a program under the Soil Conservation and Domestic Allotment Act.

Methods of Determining Bases

One problem for which a satisfactory solution has not yet been obtained concerns bases and acreage allotments. It is difficult to allocate acreages as between the several regions, States, and areas in such a way as to allow for changes in harmony with the principle of comparative advantage in the distribution, concentration, and production of the various commodities, and at the same time to promote soil conservation. Under the original Agricultural Adjustment Act, the base acreages of the several crops were distributed between the several States in proportion to the acreages actually grown in 1932–33, 1928–32, or some other recent period. In a continuing program this historical distribution is soon out of date. Some method must be found to allow for necessary shifts as between areas and States whenever and wherever needed.

Allocating the area or county totals to individual farms is even more difficult. There are two general philosophies with respect to this. One argues for an historical base, with acreages distributed in direct proportion to past performance, and the other for a conservation and good farm-management approach. The two approaches usually result in an entirely different distribution of acreages as between individual farms. The Administration started with the historical base approach in 1933 and 1934, but has gradually been working toward the good farm-management approach. But the good farm-management approach may result in payment of the bulk of the funds available to groups of farmers for following the same cropping systems they would follow without a program, while other farmers may decide not to cooperate and may increase their acreages.

CROP INSURANCE PROVIDED FOR WHEAT GROWERS

The passage of the Federal Crop Insurance Act this year was an important step in farm legislation. Applicable only to wheat, it is an experiment that may lead eventually to insurance protection for the producers of other crops. Its principal objective is greater security for the farmer. It is the counterpart of the Social Security Act, which provides unemployment insurance for nonagricultural workers.

Scientific developments and good farm management cannot completely eliminate crop failures, and farmers need a social device that will ease the burden of unavoidable crop losses. It may consist of a fund or reserve out of which payments can be made to those who suffer crop failure. Such a fund might be built up with private contributions of a charitable nature, with public contributions, or with contributions from those who will benefit from it. Insurance falls in this last class.

Some types of insurance involve little relationship between the contribution by the insured and the probable amount he will need out of the fund or reserve. Other types require a serious effort to fix the contribution in premiums as nearly as possible to the probable amount that the insured will draw from the fund or reserve. Many social insurance schemes have followed the first plan. All the prospective beneficiaries contribute alike, and the benefits go to those that need them. Such a plan works best where the insurance is compulsory. Under noncompulsory plans where all contribute alike, the participation may be largely by persons likely to draw more from the fund or reserve than they contribute to it.

The Federal crop-insurance program is on a voluntary basis. Hence it attempts very definitely to measure the probable benefits that will be paid to each insured person, and to fix the premium on that basis. All who participate have an equal chance to withdraw from the reserve the amount they contribute. This method tends to eliminate an adverse selection of risks and does not penalize the capable, efficient farmer or the better producing areas.

Premiums Represent Average Crop Loss

The individual farmer pays each year a premium that represents his average crop loss. He budgets his crop losses and meets them in equal installments rather than as they occur. He collects on his insurance in years when the loss occurs. Budgeting is not new to farmers. The purchase of farms on the installment basis and the retirement of mortgages by regular amortization involve the principle. Farmers cannot pay large lump sums out of their income from a single year. They cannot successfully meet crop losses on that basis. Without insurance or other reserves the farmer who suffers a severe crop loss must borrow. It may take him years to repay the loan. This is meeting losses after they occur. Under an insurance plan the farmer starts meeting them before they occur.

The losses may not occur for years. Meantime, the insured farmer contributes to the reserves of the insurance corporation an amount that will be pooled with other contributions to meet individual claims as they arise. This is good business and good farming practice. Farmers regularly carry reserves against emergencies, either as cash in the bank, as investments, or in feed, grain, and other farm products. But the ordinary farmer finds it difficult to lay aside enough to carry him through even 1 year of complete crop failure. It takes years of saving. Participation with other farmers in an insurance plan gives him the protection of a large joint reserve immediately. This is far more effective than a large number of individual reserves. The joint reserve is available for use wherever the need arises; it is in more constant use than individual reserves; it can be used far more efficiently than individual reserves that total the same amount; and it furnishes much more protection.

Gross farm income is the combined result of production and prices. Production is partly the result of natural forces that are recurrent and to some extent predictable. Prices, however, are the result of changing economic forces and are much less predictable. Therefore the Federal crop-insurance program for wheat insures only production, and not prices. Insurance companies have experimented with price insurance and found it too risky.

Payment in Kind

The Government plan calls for payment in kind. It insures the farmer a production of a certain number of bushels of wheat. He pays premiums in wheat. If he fails to produce that amount, he receives the indemnity in wheat. For reasons of convenience the actual payment of the premium or of the indemnity may be in the cash equivalent. But the cash premiums will normally be invested in wheat and funds for the payment of indemnities in cash will normally be obtained through the sale of wheat.

This type of insurance in kind builds up an ever-normal granary, out of wheat premiums paid each year. It is drawn on primarily in years of widespread crop failure. The net flow is into the reserves in good years and out of the reserves in years of severe crop failures. An amendment to the Federal Crop Insurance Act provides that premiums may be paid to apply on insurance for an additional year in advance. Farmers will make these advance payments in years when the crop is large and the price is low, and this procedure will accentuate the ever-normal-granary aspects of the program. As the crop-insurance program accumulates reserves of wheat, it may become an important factor in stabilizing the level of domestic wheat prices. In this way the insurance program will tie in closely with the broader acreage-adjustment policies of the Department.

This method of crop insurance will not weaken the farmer's incentive to take good care of his crop. That might happen if the crops of all farmers were insured for the same amount per acre and at the same premium rates. But the plan bases the amount of insurance per acre on the yield experience of the farm. In large measure the premium depends on the crop-loss experience of the farm. Hence, the system gives the insured farmer an incentive to take good care of his crop, so that he may obtain lower insurance terms in the future.

Insurance companies have found that giving lower rates where lower risks are involved tends to stimulate loss-prevention activities. Fire insurance is a good example. Fire-insurance companies offer lower fire rates where the insured persons have provided fire protection, and in towns and villages that have fire departments. The differential between high- and low-risk areas is an important factor in stimulating the introduction of better fire-prevention methods. There is every reason to expect comparable results from differential rates in crop insurance, which will encourage farmers to minimize their crop hazards by every available means.

Some farmers use quite expensive methods of protecting themselves from crop losses. These farmers may find insurance cheaper and equally effective. Where methods of loss prevention are very expensive, insurance may be the socially desirable alternative. Fewer automobiles would be stolen were all cars kept in locked garages. But the social cost of building a garage for every car might greatly exceed the value of the stolen cars. In like manner, it might be less expensive for farmers in many areas to insure themselves against crop losses than to go to the expense each year of elaborate loss-prevention practices.

Actuarial Data for Wheat

One reason for starting the crop-insurance experiment with wheat was the fact that better actuarial data were available for wheat than for other crops. Studies are under way with regard to the possibility of insuring other crops. If the program succeeds with wheat Congress may extend it to cotton and corn. Another advantage in beginning with wheat is the fact that after the seeding of the crop there is little to be done except to harvest it. With other crops cultivation is an important factor and this raises additional problems, and creates a need for special safeguards to prevent losses from lack of care.

Still further integration of the crop-insurance program with other programs of the Department may be feasible. Farmers who are entitled to A. A. A. payments might be permitted to authorize a transfer of all or part of their payments to the Federal Crop Insurance Corporation as premium for crop insurance. This would eliminate the necessity to make certain payments and collections to the extent that the two operations would offset each other.

Possible Extension of Principle

Consideration might be given also to the possibility of extending crop-insurance protection automatically to all farmers who participate in the conservation and adjustment programs. This protection could be given to them in lieu of cash payments equal to the amounts of the premium. Essentially, the operation would provide for larger A. A. A. payments to the farmers in years of crop failure and smaller payments in other years. The principle has been incorporated to some extent already in the Sugar Act of 1937.

Both the A. A. A. and the crop-insurance program aim at a more stabilized agriculture. Farmers who contribute to this end through acreage adjustments or conservation practices should have insurance against crop losses. Such an arrangement would be advantageous from an administrative standpoint. It would reduce the sign-up costs and the premium-collection costs of the insurance program.

One disadvantage of the plan is that there would be less selectivity in the insurance program, and this might necessitate higher premium rates than would be required if the Corporation could select those it

wished to insure. Moreover, many farmers with savings or widely diversified sources of income have little need for crop insurance. It would probably be unwise to require that such farmers should take out crop insurance as payment for their participation in the general program. Exception to participation might be provided for at the request of the individual farmer. What scope exists for extending insurance protection automatically to participants in the A. A. A. programs deserves careful study.

MARKETING AGREEMENTS AND SURPLUS REMOVAL

Federal legislation provides two principal means of dealing with agricultural surpluses—crop adjustments and marketing agreements. The second of these procedures has proved particularly useful in handling crops not covered in the acreage-adjustment programs. It enables the Secretary of Agriculture to enter into agreements with distributors, processors, and producers for the purpose of lessening competitive wastes, improving trade practices, moving surpluses into consumption, and raising farm-commodity prices. In 1937 marketing agreements covered products valued at about $340,000,000 and affected 1,500,000 growers of fruits, vegetables, and dairy products.

These agreements helped to moderate price fluctuations, to distribute supplies more efficiently among the available markets, and to facilitate orderly selling throughout the marketing seasons. Only the milk agreements actually sought to fix prices. The others simply regulated the movement of supplies so as to obviate local and seasonal gluts and shortages. They benefited farmers through liberal marketings at prices calculated to encourage consumption. Sometimes the agreements withheld low-grade products from commercial channels, or supplies for which there was no remunerative demand. But the main emphasis was on efficient, unimpeded marketing. It seldom pays to restrict market supplies severely. Experience with the agreements served as a new reminder that total farm income is a function of sales as well as of unit prices.

Marketing agreements promote consumption at reasonable prices through the regulation of shipments on the basis of volume, grade, and size. This evens out the flow in line with what the markets can readily absorb, reduces the costs of marketing, and gives consumers a more uniform and eventually a larger supply of commodities at prices in harmony with their purchasing power. It is far better for all concerned than spasmodic marketing, which forces prices up and down alternately, and reacts adversely on the costs of production.

Originally, the marketing-agreement plan embraced only commodities included in proposed acreage-adjustment programs. It was an alternative approach to the handling of wheat, cotton, corn, hogs, tobacco, and rice. Farmers' cooperative associations fought to broaden the principle. They saw in it a way to strengthen cooperative marketing, and to benefit the producers of all crops, rather than just the basic commodities. As finally passed, the first Agricultural

Adjustment Act authorized the application of marketing agreements to any agricultural commodity or product. The marketing-agreement program came to depend greatly on cooperative marketing, and succeeded best with crops handled through strong cooperative associations.

Many Changes Since 1933

It has undergone many changes since 1933, some of them the result of court procedures and decisions. After the United States Supreme Court invalidated the N. R. A. in the Schechter case, Congress amended the A. A. A. marketing provisions, which previously had authorized voluntary agreements and regulatory licenses, and had seemed to involve some delegation of congressional authority to administrative agencies. Amendments in 1935 substituted orders for licenses and directed the procedure more precisely. They authorized orders only for certain specified commodities in the dairy and fruit and vegetable industries, and exempted apples and fruits and vegetables for canning. Cooperative associations obtained a more definite place in the program, and applied democracy gave farmers more voice in starting and shaping programs.

For example, the amended law required the Secretary of Agriculture, before putting any order into effect, to find out whether or not the interested producers wanted one. Every order required the approval of two-thirds of the producers or the approval of producers representing two-thirds of the normal production. This led to the organization of administrative committees substantially representative of producer interests. There was no delegation of authority to these agencies; the law had been amended specifically to bar such action. But the administrative committees received wide scope to recommend policies, procedures, and regulations.

In this respect the procedure was a new departure. Representatives of processors and handlers, rather than of producers, had showed the greatest initiative in 1933. They had crowded the halls of the Department in Washington with proposed agreements in their brief cases. Handlers and processors of agricultural commodities had offered eagerly to adopt agreements and to combine for the coercion of recalcitrant minorities through licenses. Producers had remained rather in the background. The amendments of 1935 brought them forward. As was originally intended, farmers became the main support of the marketing agreements. Meantime the enthusiasm of the processors and handlers declined, particularly in the long-time features of the marketing-agreement program, with their emphasis on the stabilization of supplies and the reduction of costs.

This divergence of interests was natural. Growers, with their investment in land, machinery, and buildings, must take long views. They want the best return over a long period, rather than high prices in just one season. This may require them to sacrifice the present for the future, and to embark on storage operations and acreage control. The long-time interest outweighs the value, for example, of

price-fixing arrangements, which usually work only for one producing season. Supply-control features of the marketing agreements, which may involve some decline in immediate shipments, interest the producers far more than they interest the handlers of farm commodities. Regulated marketing is principally a concern of the producers, and only a secondary interest to distributors.

Producers, Handlers, and Consumers Benefited

Ultimately, greater stability in supplies and prices benefits producers, handlers, and consumers. This principle is the heart of the marketing-agreement programs. The application of it is complex. It requires minute study of numerous interacting factors, some of them very obscure. After marketing agreements have lessened disorder in marketing and reduced the shipment of immature and inferior quality products, the possibility of further accomplishment arises, through means that may simultaneously increase the incomes of producers and assure consumers a more adequate supply of better quality products. Experience with the marketing agreements is beginning to disclose important new possibilities, the realization of which should make the common interests outweigh the conflicting interests in agricultural marketing.

There is an important field in connection with the stratification of demand, which results from the differentiation of consumers by income levels. Heretofore agriculture, though it separates commodities into various grades and sizes, has taken small advantage of this factor. It has not tried systematically to develop outlets for different grades and qualities. Manufacturers do so; they offer different products for consumers in different income groups. Farmers can do likewise, with benefit to themselves and to consumers, particularly those in the lower income groups. Marketing agreements may be a means of tapping undeveloped strata of demand.

Controlled marketing, with proper separation of commodity grades and sizes, may increase consumption significantly. We need to study the technical, economic, and social forces that affect prices, and to know more about the elasticity of demand for various grades of products. The whole question of prices, in their relationship to the volume of production and to the grades and sizes of fruits and vegetables offered in the markets, requires more analysis, which may reveal new opportunities for stimulating both production and consumption, particularly through the elimination for low-income groups of costly packaging and services.

Marketing Agreement Act of 1937

When the Supreme Court invalidated A. A. A. production-control and processing taxes, it clouded the status of the marketing agreements. Certain district courts held that they became invalid along with crop adjustment. Others said they did not. To clarify the matter Congress passed the Agricultural Marketing Agreement Act

of 1937. This law amended and reenacted the marketing-agreement and order provisions in separate legislation. It continued the means for controlling market supplies of fruits and vegetables and of fixing minimum producer prices for milk. Experience in early agreement and license programs demonstrated the impracticability of fixing prices for fruits and vegetables, but the act authorized price posting as a means to make price information more readily available and to encourage a greater degree of price stability. Suits challenging the act of 1937 are pending in the courts, among them several that affect milk agreements, and the question may eventually come before the Supreme Court for decision.

Marketing agreements have definite limitations and are by no means a cure-all. They cannot guarantee the farmers a market for all that they produce, or maintain prices out of line with supply conditions. Farmers need more than marketing agreements in working out their problem. After an agreement has done its utmost, farmers still need to regulate new supplies, to keep down their costs of production, and to adjust each crop to the particular conditions local, national, or international that principally affect it. The job of promoting agricultural welfare lies only in part within the field of selling. What can be done there depends greatly on what can be done in technology, cost control, and supply adjustment. It depends also, and perhaps even more, on action in fields remote from agriculture, as for example in the determination of factory production and wages. The best marketing agreement conceivable can accomplish little if consumers have insufficient buying power.

It is important in framing marketing agreements to aim at definite objectives, which should be set at the beginning of each season. They should envisage long perspectives. Ultimately, the support of prices depends on the adjustment of marketing to actual buying power. Relief from spasmodic operations, launched without regard to the basic controlling forces, may come dear. As surpluses accumulate, the temptation increases to rely on surplus removal with Government funds. Surplus buying does not create a permanent market with renewable buying power, but simply draws on existing purchasing power through Government channels. Though temporarily desirable, and often very effective when coordinated with marketing agreements, it is no substitute for the buying power that results from actual new production in the urban centers. Marketing agreements must rest ultimately on buying power that consumers earn.

Milk Marketing

Getting milk to the consumer has grown complicated. It involves intermediate handlers, processors, and distributors. Gigantic corporations, interlocked with holding companies, largely control the distribution and processing. Milk producers can deal efficiently with such corporations only through marketing associations; they have extensively developed cooperative marketing. With producers and distributors meeting on even terms, dairy markets have some sta-

bility. Yet unorganized producers often cause uncertainty and insecurity, and chaos reenters the situation in every crisis or depression.

Extreme disorganization occurred after 1929. One result was the Federal marketing program for dairy products, with price-control features not provided in the fruit and vegetable program. Milk admits of price fixing, because prices can be applied to definite marketing areas which, through sanitary or other regulations, may distinguish their milk from all other milk. Another advantage is the system by which secondary outlets take milk in excess of fluid-market requirements. Majority opinion among the producers favors marketing agreements in most of the milk sheds, and many agreements are in effect. They fix minimum prices and create price pools to provide for more uniform payments to producers.

Most fluid-milk markets have developed a two-price system—one price for fluid milk for immediate consumption, and a lower price for milk used in making butter, cheese, and other milk products. This is necessary because the nature of the dairy industry gives it operating and seasonal surpluses. But the two-price system seldom operates without friction. Turmoil results from the attempts of distributors to reduce their costs, from the desire of producer groups for bigger shares of the available market, from differences in the prices paid by different distributors, and from lack of fairness in the allocation to producers of the so-called surplus milk. Marketing agreements help to eliminate such friction, and to establish more equitable relationships among the individual producers, between the producer group and the distributor group, and between the entire dairy industry and the consuming public.

After 1933, more than half the States enacted milk-control laws, under which State agencies issued regulations regulating intrastate commerce in milk. Marketing agreements under the Federal law supplemented the intrastate regulations.

Regulations under the Federal Marketing Agreement Act are in litigation. In October 1937 the Government obtained temporary injunctions that required dealers to comply with a Boston milk order and to pay money due under it since last August into an equalization pool. If the Government wins the case, the money will be prorated among milk producers. Essentially, the issue is whether or not Congress has the power to fix prices that dealers must pay to farmers for milk and to require the payment of these prices in a fair manner.

Surplus-Removal Operations

Surplus-removal operations through the Federal Surplus Commodities Corporation involved an expenditure of $54,000,000. They covered the purchase in varying quantities of more than 40 different agricultural commodities for relief distribution through State welfare agencies and also 18 diversion programs. The diversion programs developed new uses and new domestic and foreign markets for agricultural products. These programs served the twofold purpose of making agricultural surpluses available for the relief of distress

and of relieving farmers to some extent from the price-depressing influence of the surpluses.

Purchases for relief use amounted to about $45,500,000 and covered more than 1,000,000,000 pounds of foodstuffs. An average of over 2,000,000 families a month received the products. Since the object was partly to encourage a net increase in food consumption and to provide a more adequate diet for families on relief, the State welfare agencies distributed the purchased commodities to these families as an addition to the supplies they were already receiving from other sources. The remainder of the $54,000,000 expended went into the diversion programs.

Funds for both the relief distribution and the diversion programs are available out of customs receipts. The 1935 amendments to the Agricultural Adjustment Act (sec. 32) assign to the Secretary of Agriculture an amount equal to 30 percent of the annual customs receipts "for surplus-removal operations to encourage domestic consumption by purchases for relief use and for developing new uses and encouraging domestic and foreign markets." Congress has earmarked part of the money for cotton price-adjustment payments and other uses. About $79,000,000 will be available from the same source for surplus-removal and diversion operations in the fiscal year 1939.

Farm surpluses and factory shut-downs necessitate surplus-removal operations as a supplement to other rural and urban programs. Urban unemployment means low urban buying power. It is a direct cause of surplus accumulation on the farm. Needless to say, we do not touch the root of the trouble through surplus-removal operations. Yet surplus relief buying keeps farm prices from falling as low as they would fall otherwise and at the same time relieves want. The Federal Surplus Commodities Corporation does not try to fix farm prices or to raise and hold them much above the natural market level. It enters the market only in emergencies. True, surplus buying may raise consumer prices at times, but the farm price of many products is only a small fraction of the consumer price, and a substantial increase to the farmer may involve only a small increase to the consumer. Moreover, surplus removal may keep producers from being forced out of production and may head off extremely high prices later on.

Commodities Distributed in 1938

In the fiscal year 1938 the corporation purchased quantities of the following commodities for relief distribution: Potatoes, dried skim milk, butter, cheese, whole-wheat cereal, rice, potato flour, wheat flour, dried beans, dried peas, cabbage, dried peaches, dried prunes, dried apricots, raisins, dried apples, fresh apples, cottonseed-oil shortening, grapefruit juice, fresh grapefruit, eggs, and potato starch. The diversion operations covered flour, unshelled pecans, shelled pecans, walnuts, potatoes, sweetpotatoes, peanuts, tobacco, and cotton fabric. Each program specified the kind of commodity to be purchased and also the maximum quantity. It announced a maximum price and

defined the area in which the purchases would be made. Besides aiding the poor, it sought to increase returns of the growers on their entire crop. This involved purchasing that part of the crop for which there was no immediate commercial demand.

The corporation appointed committees of growers to help in the work. These committees learned much themselves and taught other growers much about the relationship between the purchase programs and agricultural marketing. Growers came to appreciate the inadequacy of merely seasonal or sporadic efforts to solve their marketing problems, and planned more continuous action. They got a close-up of grading, inspection, and other desirable marketing practices, since the programs usually specified the commodity grades that would be purchased. Growers obtained an insight also into shipping problems, and into such factors as the food-consumption habits of different areas, the ability of different commodities to hold up under long hauls, the importance of not shipping commodities from one surplus area to another, and the necessity of distributing relief commodities among the States on the basis of relative needs.

Welfare agencies in each State maintained a complete distribution system with warehouses, trucks, repackaging equipment, accounting systems, and personnel. They observed three major principles: (1) That goods shall be distributed only to persons certified as eligible by the accredited State or local service agency; (2) that the commodities shall be given in addition to, rather than as a part of, the relief that local agencies distribute; and (3) that commodities shall be distributed at not to exceed certain specified quantities per family per month, so that they will not interfere with normal purchases.

COORDINATING RESEARCH, PLANNING, AND ADMINISTRATION

In previous annual reports I have dealt with the purposes of the programs administered by the Department and with the steps taken to achieve them. In this report I want to deal also with the administrative machinery. The assignment of new duties to the Department in the last 5½ years has increased the need for administrative efficiency. The new duties include programs for crop adjustment, crop insurance, soil conservation, marketing agreements, tenancy reform, the rehabilitation of the disadvantaged in agriculture, the purchase and development of submarginal lands, research, demonstration, and actual erosion-control work under the Soil Conservation Act of 1935, land treatment for flood control, farm forestry, improved utilization of water facilities, and increased forestry and wildlife activities. Because of these programs the Department has become virtually a new institution. In all of them it is essential to coordinate research, administrative procedures, and action through Federal, State, and local agencies.

The legislative and the executive branches of the Government have put forth enormous and indeed unprecedented efforts to provide for

agriculture a stable income and a balanced relationship with the rest of our economy. They have endeavored also to promote the conservation of basic resources, to give farmers greater security of tenure, and to make the production, distribution, and utilization of agricultural products more efficient. The enactments that constitute this comprehensive program were not developed in the past simultaneously. Moreover, some of them were subsequently amended in the light of experience, court decisions, and changing conditions. Some administrative changes in harmony with these developments have been made every year since 1933. Our accumulated experience has enabled us this year to take more comprehensive steps toward improved administrative organization and operation.

Some Major Changes

Recently I announced some major changes in the structure of the Department. These changes unify four lines of work that have assumed high importance as a result of the new responsibilities laid on the Department by Congress in recent years: (1) The forming of programs and plans to guide the entire group of agricultural, conservation, and marketing services to farmers and to the general public was assigned to the Bureau of Agricultural Economics, which was charged with Department-wide responsibility; (2) the execution of marketing work was lodged in four units responsible to the Secretary through a Director of Marketing and Regulatory Work; (3) the execution of all physical land use programs which involve operations by the Government on farm lands was consolidated in the Soil Conservation Service; (4) research work in the field of agricultural and industrial technology was placed under unified direction.

It had become imperative to establish over-all planning work for the whole Department so as to provide for the proper functioning of the many new activities authorized in recent years by the Congress. This had become all the more necessary since the Department in July 1938 entered into a significant and far-reaching agreement with the Association of Land-Grant Colleges and Universities. For a quarter of a century the State extension services and the Department have fostered local planning by farmers. With the beginning of the present action programs the Department sought to have farmer participation not only in the administration of the program themselves but also in the necessary planning work back of the programs. The Agricultural Adjustment Administration and the land-grant colleges have given increased attention to this object since 1935. Two years ago the Association of Land-Grant Colleges and Universities appointed a committee on Federal-State relations to work with a similar committee here in the Department, and on July 8, 1938, the association and the Department declared their intention to cooperate in establishing democratic and cooperative procedures and institutions that would give farm people an effective voice in formulating, correlating, and localizing public agricultural programs. Farm people and official

agencies in the States are now forming community, county, and State groups to carry on land use planning and program building. In the expanded Bureau of Agricultural Economics the Department has established its part of the machinery needed to integrate State and local planning with general planning and program-forming activities within the Department.

Marketing and Technological Work

It was necessary also to consolidate the marketing work so that the same concentrated attention may be given to it that we now devote to production and conservation and also to keep our marketing work in line with the broad plans formulated by the Bureau of Agricultural Economics and to give citizens who deal with our marketing agencies a central point of contact with them. The changes in the planning and marketing work more clearly delineate the functions of the Agricultural Adjustment Administration and will allow its officers to give their complete attention to administering the national conservation and adjustment program, to providing an ever-normal granary through commodity loans and marketing quotas, and to making parity payments when authorized. The consolidation of physical operations in land use programs for farm land makes it possible for farmers to deal with a single agency on all matters involving physical work on their land. The purpose of bringing technological research together is largely to speed the attack on the problem of widening the uses for farm products, in which field the Department has already achieved a successful record. Congress has provided for the expansion of this work and the administrative consolidation should promote it efficiently.

In providing for the Department's action programs, the Congress defined their scope, basic policies, and objectives, and in a general way indicated methods of administration. It recognized the administrative problem involved, however, and directed the Secretary to use the resources of the Department in the most practical and workable way to attain the ends sought. Some of the acts placed the full responsibility for administration upon the Secretary, others directed the Secretary to use existing agencies for administration, and still others permitted the Secretary to distribute functions among the various agencies of the Department. This responsibility required the development within the Department of efficient and direct methods of administration.

In making numerous administrative changes during the past 5½ years, the Secretary has kept three principles in mind:

(1) Farmers must participate in forming and executing their own programs.
(2) Since each program is part of a comprehensive agricultural land use program, we must provide for continuing coordination within the Department.
(3) Administrative alignments, under responsible chiefs and administrators, should bring together types of programs that permit the personnel involved to develop judgment, foresight, and efficient methods and to avoid duplication and overlapping.

Planning Coordinated With Administration

There are other important considerations in planning national and local agricultural programs. It has become clear that we must not wholly divorce planning from actual administration. Another consideration is the essential unity of the farm problem. The problems of erosion, tenancy, prices, farm income, flood control, submarginal lands, crop insurance, and rehabilitation all impinge on one another. Moreover, just as planning is dependent for its soundness on farmers' participation, so also it is dependent on having the Department and the colleges continue to develop land classifications, surveys, comprehensive land use plans, and programs through their staffs of experts. Farmers need the help that specialists can provide, and specialists must draw on the experience and judgment of farmers. The need, therefore, is to provide for integrating and unifying the planning of both groups as a guide to all public agricultural programs.

Within the Department, each action agency at present engages in two kinds of planning—general planning to determine the major adjustments needed to promote a healthy agriculture, and the detailed planning which is an inherent part of administrative operations. The difficulty is that the judgments formed in connection with, say, erosion-control work for a given area may not be in accord with those formed in connection with a crop-adjustment program; or the general objectives established for a submarginal land-readjustment program may not be wholly in accord with those developed for flood control. The problem, hence, is to provide for formulation of our broad objectives cooperatively, with all agencies agreeing on the basic facts, accepting common standards, deciding on priorities, and formulating commonly acceptable judgments. This cannot be realized without some machinery for bringing the right people together at the right time and for considering the right questions. We needed to establish departmental machinery which would enable local and State planning to reach the Secretary in a significant and usable form, and which would integrate the general planning and program-forming activities within the Department. These things have been done through the structural changes announced in October.

Federal-State Relations Clarified

In their joint memorandum of July 8, the Department and the land-grant colleges agreed specifically to recommend that each State extension service should set up in each agricultural county an agricultural land use planning committee, as a subcommittee of the present county agricultural program-building committee. They agreed that this subcommittee might well consist of at least 10 farm people, some forest landowners in counties where forestry is a problem, the county agent, at least one member of the A. A. A. administrative committee, the rural rehabilitation supervisor, and any other State or Federal official in the county who has responsibility for the administration of land use programs. The land use planning subcom-

mittee will study proposals and programs developed by community or neighborhood groups, and correlate them on a county basis. Community groups of committees of the required type exist already in many counties. Where they do not exist they will be established.

In addition, each State will have an agricultural land use program or policy committee. This group will act as a subcommittee of any State agricultural program committee that may exist. It will act independently if there is no State program committee. The chairman will be the State director of extension. Among the members will be the director of the State experiment station, the chairman of the A. A. A. State committee, the Soil Conservation Service State coordinator, the Farm Security Administration State director, the land use planning specialist of the Bureau of Agricultural Economics, a representative of the Forest Service, and any other State or Federal official with responsibility for the management of land use programs. There will also be a number of farmer members, usually one from each type-of-farming area within the State. Preferably these farm members will also be members of one of the county agricultural land use subcommittees.

This plan should vitalize the land use programs through direct and frequent consultation among farmers, State officials, and Federal officials. It makes farmer thinking dominant in the county subcommittees and in the correlation of community plans on a county basis. It retains farmer influence in the correlation of county material on a State basis and in the correlation of State material on a national basis. Federal officials will consult the State subcommittees and receive their suggestions and criticisms before actually launching any program.

Farmers' Place in Program Planning

This whole arrangement is simply a means to an end. It is a procedure for enabling Federal and State agencies to agree with farmers on the long-time land use goals, and of coordinating action taken toward these goals so that different programs will complement and support one another. As the essential prerequisite, the agreement provides for the organization and distribution of necessary information among farmers and Federal and State administrators. This is very important. It does not suffice that the proper organized knowledge should simply exist. This knowledge must be in the possession of everyone concerned in land use planning and action; otherwise, the tendency will continue to seek one thing without sufficient regard to the other ends that should be promoted simultaneously.

In land use planning for different regions we need to blend many different kinds of information. Are the land units so small that they will never furnish a livelihood? Are some public agencies promoting the relocation of farmers in submarginal areas? Is credit policy integrated properly with land-purchase or crop-readjustment programs? How far can soil-erosion control through physical procedures be effected independently of action to sustain farm income

or improve tenure conditions? Are we seeking to control erosion through benefit payments in areas where the controlling factor is the farm income or the prevalence of tenancy? What about the correct priorities in land use planning—the order in which different things should be done? It is important to tackle first things first. Without an interchange of findings among different specialists, and without proper coordination of the results, we cannot know the correct priorities. There is then a real danger that particular programs, such as crop adjustment, soil conservation, and flood control, may not harmonize in their immediate and long-time effects, and may consequently throw the farming system still further out of balance.

Efficient land use planning and action must rest on definite concepts as to what will constitute better land use in different areas. The process of developing these concepts is planning. The result should be the establishment, by areas, of long-time land use goals to serve as guides in all the action programs. Research is necessary for each area to indicate the needed changes specifically. This research, however, cannot be simply the mechanical summation of independent inquiries along different lines. It must be organized in advance, in terms of the combined general objectives, so that the component projects will constitute an organic purposeful whole. There must be teamwork in approaching the goal as well as in the coordination of action programs afterward.

Land Classification Needed

For example, an immediate requirement in land use planning is land classification. In this work the community and county committees can help. Many of them have already mapped land use areas for extension programs. These areas may need to be subdivided into fairly homogeneous local tracts for subclassification. Obviously, the areas should be fairly uniform, not only as to the major type of farming but as to the combination of soil types and slopes, the extent and severity of erosion, the proportion of land in crops, pasture, and woods, and the farming systems in general use. Community committees can locate these areas fairly well, provided they clearly conceive the multiple purposes in view. It will not suffice to base the determination of homogeneous local areas on merely physical data. Land use planning requires information also with regard to tenure conditions, assessed valuations, tax delinquency, size of farm holdings, and the relationship of the existing land uses to farm prices, markets, and incomes.

Next it may be useful to put the homogeneous local areas into three major classes: (1) Land now in farms that should remain in farms; (2) land that is not suited to farming; and (3) land not yet in farms that is suited for farming. This, too, is a very complex job, involving social and economic as well as physical criteria. Obviously, it must be done with standard yardsticks; otherwise, the results will be useless for national land planning. Uniformity in the land classification method requires a preliminary agreement as to land use objec-

tives. Classification based on uniform principles will furnish the basis for an agreement among Federal, State, and local agencies as to long-time land use goals.

On that basis the A. A. A., for example, will be able to accomplish more with its funds. It will know where the need for land use adjustments is most urgent and will know specifically what farm practices it should encourage in different areas. The Soil Conservation Service likewise can take advantage of the uniform-area classification. It can develop district programs and demonstration areas and can do other work, with a fairly exact knowledge of the economic or social obstacles it will combat. Flood-control and water-facilities programs can be developed with due regard to their effects on farm income. The Farm Security Administration will have data as to the conditions it should lay down in making rehabilitation loans. Extension workers will be better able to combine various types of special knowledge in local educational programs, and to fit these programs in well with State and national farm readjustments.

Land that is properly in farms may need various types of adjustment. It may call for changes in crop rotations, for the increased use of fertilizer or lime, for strip cropping, terracing, and contour plowing, for better pasture and woodland management, for some modification in the average size of the farm units, for some readjustment of tax burdens, or for attention to the prevailing land-tenure conditions. Community committees, with their knowledge of local conditions, may be in the best position to indicate some of the requirements, while sound judgment with regard to other factors may depend on a correlation of the local data with broader information.

Development of Conservation Goals

Usually the development of satisfactory conservation goals will require the permanent collaboration of county, State, and National agencies. This applies also to land in the second major classification; namely, to land classified as unsuited to farming, where the farm income is too low to maintain the farm plant or where so-called subsistence farming fails for lack of supplementary nonfarm work. Handling such land is a problem in economics and rural sociology as well as in agronomy or erosion control. It calls for economic democracy at once local, State, and National through interconnected program planning on all three levels.

Moreover, action with regard to land suitably in farms and to land unsuitably in farms entails action also with regard to the third major land classification. Obviously, land planning must extend to the land not yet in farms or it will be relatively ineffective. Farm expansion even into good land may do harm if the economic conditions are unfavorable or if the cost of drainage or irrigation or clearing is excessive. Careful surveys are necessary to indicate under what conditions new areas can be wisely developed. Only in areas suited to farming both physically and economically should public funds be devoted to relocation operations and to drainage and irrigation. It is

important to know what kind of farming has a chance in such areas and why. There is a wide field of usefulness here for the community committees.

After the community committees have done their work and provided maps, land classification, and specific recommendations for their different areas, the county committees have a task to perform. They must harmonize the community reports into a county plan, in terms of reasonably uniform standards and criteria. Then the county plans can be used in developing State-wide and Nation-wide programs. Complete information expressed statistically for the counties will form part of the data for allocating county quotas in the A. A. A. programs and for correlating State programs into a national synthesis. In many States it will be useful to include farm forestry among the desirable land use objectives and to promote a better integration of private with national forest-land use. There is need also for new combinations of farming with wildlife conservation.

Prevention of Overlapping

In short, the problem is to work out a procedure whereby the different land use activities can be efficiently combined in local, State, and National programs. At present there is some overlapping and conflict of purpose. It is impossible wisely to direct a program—for example, the Agricultural Adjustment Administration or the Soil Conservation Service program—on the basis of merely general ideas as to land requirements in the particular area. These requirements must be defined precisely in terms of needed adjustments in cropping systems, and land practices and in farm requirements for credit, tax reform, tenure reform, or size of holdings. Studies of special interest to individual Department agencies such as the Agricultural Adjustment Administration, the Soil Conservation Service, the Forest Service, the Bureau of Chemistry and Soils, or the Bureau of Biological Survey must be related to the totality of farm interests and requirements in different areas, so that the resulting final land use program will represent the different technologies in a correct proportionality.

The agreement of July 8 between the Department and the land-grant colleges is chiefly important because it will promote this better integration of diverse yet related objectives in the land use program as a whole. It will promote this end in two ways by (1) facilitating cooperative consultation for research and action and (2) creating new machinery for bringing together Federal officials, State officials, and farmers in actual land use readjustments. Official representation on the county and land use subcommittees, combined with the farmer representation on those bodies, should unite agricultural science with practical agriculture in new and vital teamwork.

NATIONAL ASPECTS OF LAND USE PLANNING

In looking back over the development of land programs in the United States, we seem to have come a long way in a short time.

Not many years ago our land economists approached the land question mainly from the standpoint of physical production, and sought to indicate the most desirable uses for different areas. They realized, of course, that land utilization depends ultimately on the economic as well as on the crop results. They knew that the criterion of good land use cannot be exclusively the physical output in crops, grass, or trees. At that time, however, facilities did not exist for dealing adequately with the economic and social aspects of the problem. Education, the main reliance in promoting better land use methods, was incapable by itself of accomplishing important reforms, and progress was slow. It was a radical new departure when Congress, with the backing of an informed public opinion, passed laws and provided funds for action programs in addition to research and education.

Everyone recognizes today that the land problem involves far more than the recommended allocation of different tracts to different crop, pasture, and forest uses. It gets us nowhere simply to ascertain the comparative advantages of different areas. With settlers pressing into unsuitable land, and with competition causing soil and forest destruction, the mere knowledge that we are doing wrong helps little. Reform through education alone is impossible. What can education by itself do with the slope cultivator who has no alternative; with the lumberman who can win a fortune through reckless cutting; with the submarginal farmers who have nowhere else to go; or with the Plains plowers who rush into semiarid lands whenever the rainfall goes slightly above normal? Land utilization obeys the pressure of social forces, and the education of the individual will not prevent mistakes. It is necessary to undertake the control of social forces.

Land as a Social Problem

As I said, this is an advance from our starting point. It is not necessarily, also, a long way toward our goal. Our period of research and of individual education was only preparatory. Actual progress began only when we tackled the land as a social problem. We took that step, so to speak, only yesterday. Moreover, we still fail to recognize the scope of the enterprise. Generally we thing of it as mainly rural. It is urban as well, because the urban and rural populations interpenetrate and continually exchange both land and capital. Land programs in this country must utilize all the agricultural sciences. They must discover means for reconciling clashes between public and private interests and develop public institutions capable of mobilizing cooperation on a tremendous scale. This is not simply a job for the farm population. It involves the whole reciprocal relationship between country and town. Much depends on the state of urban industry and trade, and on the movements of population to and from the cities. It is one thing to allocate different lands among different uses with the rural population declining, and quite another to do the same thing with city folk rushing to the land and with rural youth backed up on farms.

Our land policy is very broad already. It includes the A. A. A. programs, which combine crop adjustment with soil conservation; the research, demonstration, and practical erosion control of the Soil Conservation Service; various programs for bringing areas of grassland, forest land, and eroding farm land under unified conservational control; Federal aid to tenants who wish to become farm owners; farm-forestry programs; land buying and the diversion of poor farm land to forestry, grazing, wildlife, and recreational purposes; rural rehabilitation through loans and guidance; land treatment for flood control; and more besides. Our land policy seeks to maintain the income of farmers from efficient, properly adjusted production; to improve our land-tenure system; and to safeguard resources. These various programs make up a large order; yet they do not express the full content of our land problem, the concept of which must be broadened still more, even at the risk of making it overlap with other matters.

All men and not just farmers, graziers, and lumbermen live on the land. Moreover, all men use it. Factory folk need factory sites and home sites, and depend on the land for raw materials. Also, they produce land use machinery—farm implements and the whole apparatus required for drainage, irrigation, lumbering, mining, transportation, and road construction. This is land utilization at one remove. City folk outnumber country folk nowadays because the modern technology transfers jobs wholesale from the country to the town. They take over certain of the mechanics of farming, and let the farmer specialize more on the biology of the work. They do much that once was farming or farm employment—the carpentering, blacksmithing, implement making, harnessmaking, hauling, and what not. This gives them an equal public interest though of course not an equal private interest with farmers in land utilization. Whatever saves the land saves their jobs.

City Interest in Land Use Planning

Countryman and townsman use the land jointly. They should coordinate the work, through interacting procedures that will increase both farm and factory production in an approximation to the right proportions. Failure to move in this direction will sharpen the clash between the rural and the urban interest in the land. It is impossible for countryman and townsman to see eye to eye when unemployment shrinks the agricultural market, and at the same time forces the unemployed into farming. With the farmer anxious to keep his job, and the city worker trying to take over part of it, the cause of better land use and soil conservation goes on the rocks. Farmers think about their bills more than about the soil while impoverished city people move on to the poorer land and make it poorer. Paradoxically, the cure for many agricultural land use problems begins in the cities. Only the creation of more city jobs can prevent the continual creation of new farms in regions of poor soil.

Therefore agricultural land programs should look beyond agriculture. They must consider all land uses; those that employ the city workers directly and indirectly as well as those that employ the people on the farms. Agricultural land policy cannot be bounded by the farms, ranches, and forests, or even by the rural population; it should formulate alternative programs, one for the possibility that industrial revival will shortly restore the movement of population away from the farms and toward the cities, and another for the possibility that it will not. In the first case land not suited to farming can be shifted without excessive difficulty to forest, recreation, and wildlife purposes. In the second, the shifting will meet with strong resistance, and will need to be coupled with programs for relatively noncommercial agriculture. Responsibility for urban employment does not rest on agriculture; but the agricultural land problem cannot be solved without reference to urban conditions.

Increase of Noncommercial Farming

Modern technology has another consequence of great importance in agricultural land programs. Side by side with the commercialization of agriculture, technology produces an opposite movement toward self-sufficing ways of rural life. This is a very curious paradox. It results from the increasing productivity of the better lands. With commercial farming constantly reducing both the acreage and the labor required to satisfy the market, an increasing proportion of the rural population takes up relatively noncommercial farming. In 1929 half the farms in the United States produced only about 11 percent of the commodities sold or traded and since then the commercial production of this poorer half of our farms has dropped still more. Moreover, the number of small poor farms is increasing rapidly; it jumped 500,000 between 1930 and 1935. We have an immense neglected rural economy, which as yet has small part in the programs for crop adjustment and soil conservation. How may land programs be coordinated in the two halves of the rural system?

Either we must arrest the trend toward noncommercial farming, through the provision of more attractive urban opportunities; or we must develop special land programs for it. As an alternative to farm abandonment, which might be desirable in many areas from the standpoint of conservation, we may have to develop better types of rural self-sufficiency. As on the commercial farms, it will be imperative here also to harmonize the human with the land requirements. Scientific programs for housing and sanitation, more diversified production, better preparation of food, and the rural interchange of services without the use of money, may prove helpful. Such measures should promote better land use on the poorer farms just as crop adjustments and marketing agreements do on the better ones. Much noncommercial agriculture is on land that ought not to be in farms; perhaps the best cure is to increase the supply of nonfarm jobs. Thus the land problem touches the urban problem at another point.

Still another great aspect of the land problem extends beyond agriculture to our society as a whole. Every land program encounters it eventually. This is the separation that tends to develop between the ownership and the operation of land. It is a world phenomenon that has shaped the course of history dramatically many times, and will again. As the pressure of population increases, farmers bid up the price of land and burden the agricultural industry with debt. The result is agricultural insecurity. Buyers fail to attain full ownership, tenancy increases, newcomers invade submarginal land, and disputes arise over the division of the agricultural income as between mortgagors and mortgagees and as between tenants and landlords. History reports every conceivable attempt to deal with this problem, from the mild intervention of governments in questions of rent and tenure to violent agrarian revolution. In the United States, though already 42 percent of the farmers are tenants, the difficulty is still in an early stage. Yet the Government has found it necessary to act, through measures for the raising of tenants to ownership and for the improvement of the leasing system.

Tenure and Conservation

Land programs meet the issue at every turn. Tenants concentrate on the cash crops, and let conservation slide; debt-burdened farmers similarly neglect conservation. The smaller the equity, the less care there is for the soil. As the operation and the ownership of land diverge, land use practices deteriorate and land resources decay. Administrators of land programs should give this matter careful thought, along with the subjects that concern them more directly; otherwise, they may have difficulty in getting the cooperation of the farmers. In building up the soil, it is important simultaneously to build up the interest in it of the soil user, and give him a permanent stake in the result. Various methods should be used. It is well to aid tenants in becoming owners; and it is well also to improve the conditions of tenancy. Indeed, the latter course will promote farm ownership directly by helping tenants to plan for ownership and indirectly by decreasing the immediate competition among would-be land buyers. With less bidding, land prices will be lower and more aspirants will reach the goal. An important test of any land program is whether or not it makes the farmer's tenure more permanent and more secure.

The problem is extremely difficult. Most people agree that we should increase the farm income, assist tenants to become owners, and make improvements in the leasing system. These things will enable many farm buyers to pay off their mortgages, while others will make contracts to buy farms. Eventually, however, the new proprietors will retire, and hand their jobs over to other farm operators. Will public agencies then have to assist another group to proprietorship? And what will be in order when they in turn retire? Obviously, the process cannot be indefinitely repeated. It may be necessary to make operation rather than ownership the prior claim-

ant on the farm income. Indeed, our farm security programs move in that direction. They seek to increase the income of actual farm operators. But to keep the benefit in the operation channel, and not let it get siphoned off eventually into absentee pockets, is a problem that as yet we have scarcely begun to consider.

Interrelation of Land Uses

These observations are strictly within the confines of the land problem, which is simply a part of our general economic and social problem. Frequently, the agricultural approach begins in particular areas of submarginal farming, of extensive tax delinquency, of overgrazing, of excessive erosion, or of reckless forest destruction. It is necessary to begin there. But such problem areas are not isolated sore spots; they are outcroppings of more general disorder in the agricultural and social system. It is vital to attack also the general land use evils, of which the problem areas are merely the local expression. The task involves the combined action of many technical agencies, including those concerned with the soil, with farm management, with crop adjustment, with erosion and flood control, and with forestry. It brings physics, agronomy, and biology into an applied combination with the social sciences, in an orbit that includes the whole of agriculture and considerable segments of the urban economy as well.

There are no separate problems of forestry, of wildlife conservation, of grazing, of soil conservation, and of rational crop adjustment. There is one unified land use problem, of which forestry, grazing, crop adjustment, and so forth are merely aspects. This problem involves the whole pattern of soil, climate, topography, and social institutions; it has to do with social and economic conditions, as well as with the physical problems of crop, livestock, and timber production, and of soil and water conservation. Research and action programs must fit together, and come into a dynamic focus on the farm and on the watershed. Equally important, they must mesh with urban policy. Not otherwise can we attain the full efficient use, in town and country, of all our human and material resources.

UNDERPRIVILEGED GROUPS IN AGRICULTURE

In the pioneering period of this Nation the average farm family attained moderate success without great difficulty. Free or cheap land combined with a growing market at home and abroad and with a constantly improving farm technology lifted the American rural standard of living above that of most other countries. Occasional distress resulted from crop failures, from economic crises, or from misdirected settlement. On balance, however, the agricultural story was one of progress and prosperity and it created an impression that things would continue to go well with the farmers. As a matter of fact, the pioneering process left behind it the seeds of trouble, which

sprouted long before the post-war depressions created a general agricultural problem. Side by side with the farm population that needs mainly a restored market to give it renewed prosperity, we have an immense rural group that is either landless or insufficiently provided with suitable agricultural land.

Between 2,000,000 and 3,000,000 farm families in the United States are in extreme poverty. In fact, their standards of living oblige us to classify them as slum families. True, they do not live in extreme congestion, as do the dwellers in city tenement districts, but they have pitifully small annual incomes. Numbers of them are tenants or laborers, or occupants of farms too poor or too small to yield a livelihood. Often their homes are less spacious and convenient than city slum houses. They have scarcely any public facilities for health, recreation, education, and communication. Some of these poor farm families are in the complex commercial system; others live virtually to themselves, outside the price and market economy. Both of these groups have special problems different in important respects from the problems of the better-situated farm families. In dealing with these problems we need more adequate studies in rural sociology.

Much vital information came to light in the last complete census report. In 1929, according to the census, approximately 1,700,000 farms, or nearly 30 percent of the total number, had gross incomes of less than $600. Many of the families living on these farms earned some additional income from nonfarm work. It is necessary to bear in mind, however, that the gross farm income by no means represented purchasing power available for family living. Farm operating costs had to be met out of it. Moreover, on tenant-operated farms the total had to be divided between the land owner and the tenant. These low-income farm families probably averaged less than $300 per year in actual buying power available for the purchase of consumable goods and services. Another low-income rural group consists of the farm-laborer families. This group does not appear in the census among the farm entrepreneurs. In 1930 the Department recorded for the peak season approximately 2,700,000 hired farm laborers, many of them with families, and practically all of them in the low-income class. Not less than 3,000,000 farm families suffer the disadvantage of totally inadequate income.

Factors in Rural Poverty

Lack of income is usually the effect rather than the cause of the disadvantages suffered by these farm families. Often we must go below it to the other influences with which it may be combined. In extreme cases the lack of cash income may not be the most serious handicap—as for example in relatively self-sufficing areas where the way of farm life could be improved through changes in the size of farms or in the cropping system or in the community organization. Then, too, there are farm-tenant families whose lack of farm-home ownership may be the worst handicap. In 1935 this country had

2,865,000 farm-tenant families, including more than 700,000 share-croppers. They were not all disadvantaged or handicapped, but great numbers were poorly housed, poorly provided with community services, and poorly equipped in other ways to take their proper place in satisfactory community life. More than a half million farm families live on land so poor or so badly eroded that a decent income cannot be derived from it. They may be so scattered that the problem of providing them with schools, roads, and health services is practically insoluble. In any case it requires outside aid.

This Nation is still so young that the migratory habits of the pioneer epoch persist. In the days of the open frontier people traveled widely in search of economic opportunity. They do so still, though the search is often in vain. Most of the new land available for cultivation today requires heavy initial expenditure for clearing, drainage, or irrigation. Nevertheless, migration continues with ebb and flow between country and town in every wave of prosperity or depression. Many thousands of farm families pull up stakes each year, and look elsewhere for a chance to begin again. Not all these migrants seek new land. More than 1,000,000 farm families move from one farm to another each year. Approximately 3,000,000 persons move annually either from farms to towns and cities or from towns and cities to farms. Migration from the drought States to the Pacific coast creates difficult assimilation problems. Between 200,000 and 350,000 farm laborers, many of them with families, migrate frequently, some of them many times each year.

Problem Complicated by Migration

This migration complicates the problem of relieving farm distress. Farm people who move from place to place, and from area to area, cannot participate efficiently in crop-adjustment programs or marketing agreements. The A. A. A. benefit payments cannot follow migrating families. The county-agent system and programs for vocational education in agriculture can do little for families that constantly move about. Agricultural laborers do not participate in social-security benefits. As a result, these groups have practically only one way to get help from the Government—through relief. What this means may be judged from the fact that during the depression more than 1,000,000 farm families were on relief rolls.

There is no single panacea for these conditions. General improvement in the agricultural situation is the most important need. As the farm income rises tenants will be able to make better terms with landlords, cash income from small poor farms will be less hopelessly inadequate, and farm debt will bear less heavily on many families. But there are other requirements. Various types of farm credit can help. Already rural-rehabilitation loans have assisted 650,000 families, and rehabilitation grants have assisted an additional 400,000 families. Thousands of farmers have obtained interest reductions and farm-debt adjustments through the Farm Credit Administration.

The farm-tenant purchase program started 2,000 farm tenants on the path to farm ownership last year and will start 5,000 this year. Improvements in the leasing system will help thousands of tenants.

Much will still remain to be done. At best the above-mentioned programs cannot wholly obviate rural poverty, the causes of which are identical at bottom with those that create urban poverty. With unemployment chronic in the cities we cannot expect much lessening in the pressure of population on poor land. Commercial and financial improvement will not wholly meet the requirements of so-called self-sufficing farmers. Nor is there much scope for helping this group through the farm-tenant purchase program. Self-sufficing farmers commonly own their farms already, as a rule because the farms have little value. What these farmers principally need is a way to make better use of their land, and perhaps also a better opportunity for supplementary nonfarm work. There is need for special studies to discover improved ways of living and working on so-called self-sufficing farms.

Live-at-home farmers are numerous in the hill country of the Appalachian, the Alleghany, and in the Blue Ridge Mountains, in the Ozark hills, and in New England. There are some in nearly all the States. Frequently their land could be improved by reforestation, strip farming and terracing, and grass culture. They could grow more and better food supplies for home use and could improve their homes and home surroundings. One difficulty which they cannot overcome themselves is the decline of part-time work which has followed the depletion of timber resources. Public agencies can help to restore the timber and thus to provide additional sources of income for the noncommercial farm families.

Methods of Rural Rehabilitation

Farm families of this type are often the descendants of early settlers. Generations of their stock have been on the same land. They do not move around much. They are sturdy, self-reliant, and home loving. Government agencies can probably help them best through rural-rehabilitation programs correctly adjusted to the different live-at-home regions. Such programs would raise the standard of living of these families considerably, without adding much to the volume of farm production for sale. There is need in these areas for vocational education, which can help surplus farm youth to find nonfarm work. All the areas of self-sufficing farming are areas of high birth rate and rapid natural increase. Rural electrification may promote decentralized industry in these areas, and create new opportunities for nonfarm work.

It is necessary to bear in mind, in short, that our agricultural problem is not wholly one of increasing the agricultural cash income and of helping farmers to adjust their operations to a price and market system. Much of our agriculture is relatively noncommercial. So-called subsistence farming is a huge contemporary fact, which harks back to the precommercial era. Economic depression

increases it and obliges us to develop more or less permanent procedures for dealing with it constructively. These procedures must include efforts to improve the cultural bases of rural life. There must be studies and programs relating to home and community improvement and to recreational, religious, educational, and artistic activities. Spontaneous development along these lines can be stimulated and nurtured. Moreover, the necessary work with proper guidance can be done mainly by the rural folk themselves. It may necessitate only moderate public assistance in education, farm guidance, community organization, and health services.

LOOKING TOWARD FARM SECURITY

It has been necessary for the Government to aid more than 1,000,000 destitute farm families. Many have lost their land, their savings, and their farm equipment, and lack sufficient food and clothing. The depression has not been the sole cause of their difficulties. It has aggravated rural poverty and made the need for action more acute. But even a cursory survey shows that the problem grows out of deep-rooted maladjustments in our rural economy. These include adverse price disparities, careless and unscientific tillage practices, unsound tenure systems, a heavy burden of debt, wastage of our farming capital by soil erosion, and farms too small to provide a living.

There were two possible methods of handling the situation: (1) To support needy farm families indefinitely on a direct dole; and (2) to help them to climb back to a self-supporting status, by means of a minimum of financial aid and technical guidance. The first course would have meant a heavy and permanent drain on the Federal Treasury. It would have demoralized a large part of our farm population, without touching the roots of the problem. The second method promised to be largely self-liquidating; to transform relief families from liabilities into national assets; and to be at least an approach toward a permanent solution. It was adopted as the foundation of our rural relief policy.

Entrusted originally to the Resettlement Administration, the program is now the responsibility of the Farm Security Administration. It makes small loans to needy farm families who cannot obtain credit from any other source, and accompanies the loans with enough training in farming to insure the best possible use of the money. The size of the loans varies with the type of agriculture in each area. They average approximately $323. Usually they are just large enough to supply the family with the bare essentials for carrying on farming operations—a plow, a mule, seed, a few chickens, and other simple equipment. The loans are repayable over a period from 1 to 5 years, and carry 5 percent interest. As of June 30, 1938, loans totaling $209,366,707 had been made to 647,198 farm families.

By customary standards these families are poor credit risks. But the Farm Security Administration makes character loans. Although

it takes chattel mortgages on crops, livestock, and farm equipment, its main security is the borrower himself. It assumes that people at the bottom of the economic pyramid will pay their debts if they can. The results have justified the assumption. Most of the borrowers are typical thrifty, hard-working American families, with the rugged honesty of their pioneer forefathers. The Farm Security Administration makes the loans on the basis of sound farm- and home-management plans, worked out between the borrower and the county rehabilitation supervisor.

Typical Rehabilitation Plan

The typical plan calls first for the raising of enough vegetables and livestock to meet the family's own subsistence needs. Canning helps to provide a balanced, adequate diet through the winter months. Acreage for the production of feed provides for the work animals and other livestock. The rest of the farm may be in cash crops diversified as much as possible. The probable income and expenses are calculated, and provision is made for the repayment of the loan. The county supervisor gives the borrower any additional assistance he may require, such as advice on soil-conserving practices or on the selection of seed, livestock, and machinery.

Borrowers who are overburdened with debt may obtain help from local farm-debt adjustment committees. In the last 3 years such committees have helped to negotiate voluntary adjustments of debt in more than 76,345 individual cases. This mediation has scaled down the indebtedness involved from $251,233,883 to $188,503,032—a net reduction of $62,730,851, or 25 percent. In many instances in which the total debt was not reduced, terms and interest rates have been revised. As a direct result of this activity, local Government agencies have received more than $4,149,037 in taxes.

The program has proved surprisingly sound from a purely financial point of view. Much of the $209,366,707 advanced will not fall due for 4 or 5 years; yet more than $51,415,000 has been repaid already. Approximately 63,500 families had paid back their loans in full by June 30, 1938. Many borrowers have made substantial payments in advance. Collections have fallen seriously behind only in the so-called Dust Bowl area and in States that have suffered prolonged and devastating drought. Not one of the 647,000 borrowers was a good commercial risk. Yet at least 80 percent of the money advanced to them, and probably more, will eventually be returned to the Federal Treasury.

Rise in Living Standards

Still more significant of the program's success is the rise it has promoted in the living standards of the borrowers. A survey of 230,000 such families throughout the Nation revealed that their average net worth, over and above all debts, has increased $252 between the time they first sought aid and the end of the 1937 crop year. This

was a growth in their net assets of 42 percent, or more than $58,000,000. In addition, these families almost doubled their consumption of home-produced meat, milk, and eggs, and stored away 63,356,000 quarts of fruits and vegetables. Their ownership of work animals increased approximately 100 percent, and their acreage in livestock feed and forage crops 50 percent. Nearly 160,000 children increased their school attendance. In a fairly typical county of Texas the net assets of 660 rehabilitation borrowers increased approximately tenfold between 1935 and 1937, or from an estimated $30 to about $345. Even in the drought-ravaged States of the northern Great Plains, home production of food increased sharply among the assisted families.

Government lending could never have accomplished such results had it not been coupled with farm supervision. Rehabilitation borrowers probably would have benefited little from a mere outpouring of Government credit. They lacked training as well as cash. Many of them were tenants accustomed to moving each year to another farm. They raised only one crop, and that by antiquated methods. Their tenure arrangement encouraged them to mine the soil for every penny of immediate cash return. It gave them no incentive to check erosion, plant soil-building crops, or keep farm buildings in repair. Such borrowers profit more from the guidance that accompanies their rehabilitation loans than from the money itself.

Many families in drought areas have been refused loans because their land did not contain enough subsoil moisture to justify planting a crop. It would be a waste of the Government's money and an injustice to the borrower to attempt the rehabilitation of farm families on such land, where failure is virtually certain. In such circumstances the Farm Security Administration makes subsistence grants rather than rehabilitation loans. It approves such grants only in cases of extreme distress. They average approximately $18 per month per family, or barely enough to provide the necessities of life. From the beginning of the program until June 30, 1938, the total subsistence-grant disbursement amounted to about $72,362,000, divided among approximately 600,000 families. About 92,000 families were on the grant rolls in June. As weather conditions and other uncontrollable factors permit, the Administration will endeavor to rehabilitate these families and reduce the grant load. There is little prospect, however, that the grant program can be entirely eliminated within the predictable future.

Tenant-Purchase Program

For the farmer who has achieved self-support, the tenant-purchase and resettlement programs offer assistance in taking a final step toward security through ownership of an adequate farm.

Forty-two percent of this Nation's farmers lease or rent all of the land that they cultivate; another 10 percent rent a part of their land. Together, these tenants and part owners rent half of all the land in farms in the United States. Over 16 million people who

are members of tenant and sharecropper families are dependent upon these rented farms for the necessities of life.

Of the 2,865,155 tenant farmers in the United States in 1935, approximately 980,000, over one-third, had lived where they were less than 1 year. Most of them had merely swapped farms without advantage to themselves or anyone else. Every year a similar reshuffling takes place. This habitual moving is costly to tenant, landowner, and public alike.

As one approach to the solution of this problem, Congress passed the Bankhead-Jones Farm Tenant Act in 1937 to provide loans to help a limited number of competent tenants, sharecroppers, and farm laborers purchase their own land. Ten million dollars was appropriated for this purpose for the fiscal year beginning July 1, 1937, and $25,000,000 for the fiscal year beginning July 1, 1938. The Farm Security Administration is carrying out the program.

Funds have been allotted to each State and Territory on the basis of its farm population and prevalence of tenancy. Loans were made in 333 counties in 1937–38. Some additional loans may be made in these old counties, although most of the new loans will be made in 393 new counties designated this fiscal year. Thus, during 1938–39 loans will be made altogether in 726 counties.

These counties have been selected by the Secretary of Agriculture with the advice of State farm security advisory committees. The selection is based on the farm population and prevalence of tenancy, the availability of good land at reasonable prices, and other pertinent factors.

Funds set aside last year were enough for 1,888 loans; funds this year will be enough for approximately 4,900 new loans. These 6,788 loans will spread over the 726 counties and allow for an average of 9 to 10 loans per county. Loans for the past year averaged $4,852 per family. Four hundred and seventy-eight of the borrowing families were able to make a down payment averaging $156.69.

Loans Limited and Conditioned

Because of the limited funds available, applications must be restricted to residents of the 726 selected counties. When additional funds are made available and the program is expanded, other counties will be selected and qualified residents of these counties given an opportunity to apply for loans. The money loaned must be used to buy a family-sized farm which can, in general, be operated with labor available in the family. It should be large enough and sufficiently productive to enable the borrower to pay taxes and insurance, maintain the property, provide a satisfactory living for the family, and retire the loan for the purchase of the farm. No loan may exceed $12,000.

Applicants who receive loans have a wide choice in selecting the farms they want to buy. The price of the property, however, must be in keeping with its value, as determined by the county committee and the Farm Security Administration. Loans will include the funds

needed to make repairs to existing buildings, to construct fences, improve land, or, when necessary, to build new buildings.

The Farm Security Administration will help borrowers to develop sound farm- and home-management plans, to work out operating budgets, and to keep businesslike records.

Tenant-purchase loans are secured by a mortgage held by the Government and will be repaid over a period of 40 years. Annual payments will amount to 4.3 percent of the sum borrowed and may be made on a flexible-payment plan based on crop and price conditions which will enable the borrower to pay more in good crop years, less when adversity would ordinarily jeopardize his ownership. The loans may be paid off in full any time after 5 years if the owner so desires.

Aiding Removals From Poor Land

Sometimes needy farm people become stranded in worn-out farming areas, cut-over forests, or exhausted mining communities, where they can never make a decent living. The Farm Security Administration has helped about 8,500 such families, or more than 40,000 men, women, and children, to establish new homes on land capable of producing a decent living. They are getting a new start on 108 projects, scattered through virtually every State. The Government buys good land, builds inexpensive but adequate homes and outbuildings, and gives the settlers advice on farming methods. Sometimes the residents rent their new farms; in others cases they buy them outright, and spread the payments over a 40-year period. The Government expects to be paid back most of the money it has invested in these projects since they are largely self-liquidating.

In general, there are two major types of project:

(1) Rural communities, consisting of a number of farm homes clustered together with their own school, store, and sometimes other community facilities, such as a cotton gin. Each family makes its living by full-time farming.

(2) Scattered farmsteads, established in rural areas where schools, stores, and other facilities already are adequate. In most cases the Government merely repairs buildings and fences, arranges for the relocated family to buy or rent the farm on reasonable terms, and provides advice on sound farming practices.

These general patterns have many variations, according to the social and economic conditions of the area in which each project is located.

The construction of a complete farm unit, including house, barn, and outbuildings, has been limited, with a few exceptions, to between $2,900 and $4,200. The more expensive units are located in the Northern States, where more insulation and weather protection are necessary. All buildings are of the highest quality, and with reasonable maintenance should last considerably longer than the period required to amortize their cost.

Recently, a system of prefabrication has been developed which has made it possible to build homes at a cost of approximately $400

per room, when baths are installed, and as low as $250 per room without plumbing. For example, at the southeast Missouri project, in New Madrid County, Mo., 100 substantial five-room homes were built for a total direct construction cost of about $1,000 each.

Projects developed by the Farm Security Administration hardly begin to take care of the many thousands of rural families who have become stranded in areas where they have little hope of attaining an American standard of living. But by demonstrating a new pattern of social and economic organization, they may point toward a solution of one of the Nation's gravest agricultural problems.

FARM-LAND VALUES AND FARM CREDIT

Equity in their farms and farm equipment largely represents the lifetime savings of a considerable proportion of the farmers. Consequently changes in the value of farm real estate, and in the amount and burden of the indebtedness on it, affect agriculture vitally. Sharp declines in farm income from 1929 to 1932 reduced the ability of the farmers to retain the ownership of their farms. Gains in farm income since then, along with reductions in the carrying charges on agricultural debt, have substantially improved their position in this respect. Reflecting this improvement, the value of farm land has risen.

The Department's index of the value per acre of farm land, for the country as a whole, now stands at 85 as compared with 73 in 1933. (The pre-war period 1912–14 represents 100.) These figures compare with a peak of 170 in 1920 and with 115 in 1930. Fluctuations in farm-land values since the war have been exceptionally sharp. They have reflected corresponding changes in the demand for farm land, in farm incomes, and in interest rates. Important among the current factors in the situation are the present ample supply of credit for land transfers, the prevailing low level of interest rates, and the sharp decline that has taken place in the last decade in the total agricultural indebtedness.

Ample credit for agricultural loans affects both the demand for farms and the number of farms placed on the market. Abundant credit on favorable terms induces tenants and other investors to buy farms. On the other hand, it reduces the supply of farms on the market by facilitating the refinancing of properties that might otherwise be foreclosed. Easy credit conditions are not the only important factor in the farm realty market. Farm earnings are of basic importance. Much depends also on the comparative attractions of farm ownership and farm operation under rental contracts. It is not always more profitable to purchase than to rent farms. Sometimes the income prospects of farm ownership are less attractive than those offered by tenancy. Important to the farm buyer are farm real estate taxes and other expenses of ownership.

On outstanding Federal land bank loans the average rate of interest now is substantially lower than it was in the 1920's. Average

rates charged by other lending agencies on their outstanding loans have declined. On new Federal land bank loans the present interest rate is 4 percent, the lowest rate on record. It seems improbable that this low rate on new farm-mortgage loans will long continue. Nevertheless, the Federal land banks and the Land Bank Commissioner now hold about 40 percent of the outstanding mortgage debt, and low interest rates on this debt will be in effect for many years.

Should the mortgage credit market tighten, and current interest rates advance, farm purchases involving new mortgage credit will be to some extent discouraged. However, the present owners of farms, with mortgages written under the prevailing favorable credit conditions, will be able to obtain favorable prices. Higher interest rates tend to result in lower farm valuations; but this tendency will be somewhat counteracted by the disposition of farmers with land under mortgage at low rates of interest to capitalize the resulting increased net income in the purchase prices they demand.

Trends in Mortgage Indebtedness

Since the World War American agriculture has borne a heavy debt, much of it contracted on the basis of inflated prices. There was not much change in the total during the 1920's. Mortgage indebtedness rose from 1920 to 1928, but short-term and intermediate-term debt declined. After 1929 farm mortgage indebtedness dropped too—largely through foreclosures and distress transfers. It fell from $9,214,278,000 in 1930 to $7,645,091,000 in 1935 and to $7,254,-821,000 in 1937. This decline, though necessary to the future strength of agriculture, was a painful process to thousands of farmers. Personal and collateral loans to farmers declined also. At the end of 1936 they totaled only $593,614,000, as compared witih nearly $4,000,000,000 at the end of 1920.

There may be a swing back. The reduction in both long- and short-term indebtedness provides additional security for loans. Low interest rates reduce agriculture's annual debt charges. These developments, with other supporting factors in the agricultural situation, may cause agricultural property to rise in value, and may provide the basis for new expansion in agricultural indebtedness. There is danger here. Some growth in farm indebtedness may be desirable, particularly in short-term production credit. Some increase may be desirable also in long-term credit to finance the transfer of land from lending agencies to owner operators. But many farms still carry indebtedness that is excessive in relation to their earning power.

Moreover, farm earning power tends frequently to be overestimated, particularly when land values are rising. It makes no difference whether the advance results from an actual increase in current farm earnings or from a gain in the net income to the farmer as a result of low interest rates. Whatever the cause, farmers tend to capitalize the favorable prospects excessively, and to make them the base for an unwieldy superstructure of debt.

Farm land has been high in value in relation to current farm income for the last three decades. This has been mainly the result of a mistaken idea that farm income tends indefinitely upward. As we have discovered, it may decline for quite long periods. Rising land values from the late 1890's to 1920 permitted individual farmers to refinance accumulated debt without having to sell their farms. Lenders refunded current operating losses with new or larger mortgage loans. This prevented or postponed foreclosures and forced sales, and kept down the supply of farms on the market. After 1920 farm-mortgage financing and refinancing by the Federal and joint-stock land banks and the large insurance companies prevented many farm foreclosures. Prospective land buyers should weigh this well, and estimate carefully what the actual relation is between farm-income prospects and current farm valuations. There may still be discrepancy in some areas between earning power and land prices.

Farms in Hands of Lending Agencies

In spite of the decline in the foreclosure rate, and the increased power of farmers to retain their properties through refinancing, the number of farms in the hands of the principal lending agencies continues to increase. These farms constitute an important potential supply. Four of the leading groups of lending agencies hold about 28,000,000 acres of farm land or about 125,000 farms. What they do in disposing of these farms will be a factor in the trend of land values. Even if carefully controlled and extended over a period of years the addition of these farms to the market supply will tend to restrain any rapid upward movement in the farm real estate market. The supply of farms from forced sales and related defaults is declining. In 1937 there were only 22.4 forced sales and related defaults per thousand farms as compared with 54.1 per thousand farms in 1933. But the supply of farms in the possession of lending agencies hangs over the market.

As the lending agencies dispose of their holdings, mortgage debt will tend to increase, since mortgage credit will be necessary to finance the transfers. Liberal credit terms will tend to diminish the depressing effect of these sales on farm-land values. But the advantage may be only temporary if agricultural conditions become unfavorable before the buyers have got very far with their payments. High land charges and suddenly reduced farm incomes do not harmonize, and we have no guarantee as yet against agricultural depression. In the long run, conservative valuations are better for all concerned.

Advantages and Drawbacks of Easy Credit

Continued easy credit will bring advantages and drawbacks. It will favor an increase in net farm incomes and in farm valuations, and therefore in the equities of farm owners. On the other hand, ample funds at low interest will mean more frequent land transfers and

expanded mortgage indebtedness, and some probability that farmers who should reduce their debts will contract additional obligations. Moreover, the resulting increased farm buying may handicap tenants who wish to become owners. Larger initial payments and higher mortgage debt may mean trouble in the next depression. The advantage of rising land valuations to farmers who obtained farms during the low-value period should be weighed against the disadvantage to new buyers. Appraisal of credit policy must take account of the different needs of different groups of farmers, and reach conclusions based on the probable net results to the whole of agriculture. It is well that the older generation of farm owners, whose equities often represent their entire savings, should have land values above the present level. But it is not well that farm valuations should rise too high. There is the new as well as the older generation of farm buyers to consider, and high valuations mean a harder climb to farm ownership.

FARM-TAX SYSTEM AFFECTS LAND UTILIZATION

Taxation has an important bearing on land planning and land utilization, both through the amount of taxes levied and through the nature of the taxing system. It is impossible to consider taxes merely as revenue, because the method of raising them powerfully influences social and economic life. Taxation is indispensable to defray the cost of society's collective services; but particular tax systems may be good or bad in their social consequences. In rural taxation the methods of applying the property tax often have had socially harmful effects upon the utilization of the land.

Among the types of taxes that directly concern the farmer, the general property tax is the most important. In most States this tax has become essentially a real estate tax. Both tangible and intangible personal property largely escape the property-tax burden. Farm owners whose capital consists chiefly of farm real estate cannot escape the assessor, or otherwise avoid the tax, as owners of other property often do. Real estate, therefore, is the principal base for rural local taxation.

The only period in the past 50 years when average farm real estate taxes per acre for the United States as a whole have experienced a sustained decrease of great magnitude comprised the years 1929–34. In 1929 taxes per acre were nearly five times the 1890 figure, and two and one-half times the 1913 figure. From 1929 to 1934 they decreased by more than a third, but farm income and farm property values decreased proportionately more. Actually, relative to the farmers' ability to pay, the tax burden increased, despite the decrease in its absolute amount. It is significant that rural tax delinquency trebled from 1928 to 1932.

Since 1934 real estate taxes per acre have increased perhaps 3 percent, and they now stand a half higher than in 1913. In addition,

since 1920 gasoline taxes and automobile taxes and licenses paid by farmers have grown to an annual bill, possibly 40 percent as large as the farm-property tax bill. Within the past 5 years retail-sales taxes also have gone into operation in more than half of the 48 States.

The property tax, besides resting too heavily on real estate, bears on individual properties very unevenly. Assessments tend to be proportionately heavier on small properties than on large, and proportionately heavier on low-value than on high-value land. This inconsistency is an obstacle to conservation in that it overburdens precisely the farmers who need financial relief if they are to practice good land use methods. Unfairly heavy taxes on small or poor farms are an important cause of poor land use methods. When low-yielding lands go tax delinquent it is a fair assumption that their taxes are too high.

How Tax Reform Can Help

Tax reform in several ways can assist in promoting better land utilization. One way involves a broadening of the local tax base. A broader tax base is to be attained by a partial displacement of real estate taxes by other forms of taxation such as the income tax; and as most other taxes are better suited to administration by States than by local government, a broadening of the local tax base requires State aids, State-administered locally shared taxes, or increased State participation in some of the functions formerly considered to be purely local.

Experience has shown that two of the most costly items in State and local government, namely, roads and schools, are unsuited to local administration and financing; for efficiency they require extensive State support and control. In highway administration State, and even Federal, coordination is an accepted necessity. A few State governments have taken over their local road systems. Others grant highway aids to the local governments.

State school laws express the need for State support and control of educational facilities, and the avowed object of school consolidation is better administration and the higher quality and efficiency resulting from larger operating units. With rural roads and schools established on a broader tax base, farm taxation would be less burdensome.

Another, and related, means of tax reform involves the improvement of tax administration. Rural assessment districts are usually too small to afford trained assessors. Assessment methods are often antiquated and haphazard. Improper assessment of individual properties has been a principal cause of locally unjust distribution of tax-paying responsibility among real estate owners. Even for assessment improvement alone there is need for an increase in the size and a decrease in the number of taxing jurisdictions.

Other Means of Improvement

Still other means of reform in State and local taxation might be considered specifically to encourage better land use. They represent much less sure ground, however, than the reforms suggested above. If in a given area good land use seems to require more farm ownership by farm operators, then homestead tax exemption, classified assessment, or classified tax rates might be expedient. Elsewhere the main requirement may appear to be an improved leasing system and longer average occupancy. Tax adjustments might promote that end, too. A land-turn-over or capital-gains tax possibly could be utilized to discourage land speculation, decrease the frequency of farm transfers, and lessen the fluctuation in farm values. Also, taxation of an individual property should be variable with use of the land, so as to harmonize with land earning power and at the same time foster socially desirable land use methods.

The principle of land classification for assessment is old. In colonial days swamp pasture, permanent meadow, and plow land had different assessments. Many States classify their real estate for assessment purposes. In some cases, as with forest-tax laws, differences in the general type of land use are the criteria for differentials in tax burdens. Perhaps the method should be extended. In parts of the Great Plains, for example, current land programs call for the return of plow land to grass. In other places farmers should devote more of their land to forestry. These shifts, in which the community as well as the individual landowner will benefit, should get impetus from a taxation system based on land classification by use. Differential rates of taxation for real estate in different uses can be influential eventually in land planning.

Existing Tax Aids to Good Land Use

As yet, we do little through taxation to favor good and discourage bad kinds of land utilization. Some States apply differential assessment ratios or differential tax rates to rural and urban lands, and some distinguish the real estate of resident owners from that of absentees. Forest-tax laws generally reduce tax payments for forest properties not yet yielding regular returns. They bear lightly, for example, on cut-over land declared as forest, so that the owners have an added incentive to develop a second growth. Land classification could go much further with advantage to the community. It could distinguish desirable from undesirable land uses first within specific areas, and then within individual operating units. Differential assessments or rates could then promote appropriate uses even on a given farm, with permanent benefit to the owners and the community. There is ample precedent, and the social need is urgent. True, the principle would be difficult to apply with equal benefit to everyone; but the application need not be worse in this respect than the application of the

present system, and the social benefit could be large. The encouragement of particular land uses through differential levies could promote social and economic ends together.

ECONOMIC DEMOCRACY IN FOREST AND RANGE AREAS

It has long been the policy of the Forest Service to deal with democratically elected representatives of grazing associations. It establishes the necessary contacts through a decentralized administrative authority. Rangers and forest supervisors have full responsibility, subject to the general grazing regulations, for handling local questions, in association with local national-forest users. This arrangement, besides emphasizing the principles of democracy, makes it possible for the ranger and forest supervisor to maintain desirable close contact with all range users. Associations or individuals may appeal from local decisions.

Another democratic principle is the fact that all the members of the grazing associations have one vote each regardless of the number of stock they own. There is consequently no danger of the associations coming under the control of monopoly interests. This policy has been in successful operation for more than 30 years.

It is the regular practice of the Forest Service to consult with the national livestock associations regarding broad grazing policies that affect the livestock industry. Cooperative discussions preceded the determination, for example, of the grazing-fee question and development of the permit-distribution policy.

Forest officers maintain close and continued contact with neighborhood livestock associations. Annual meetings of these associations bring forest officers and permittees together for a discussion of range problems. Usually the meetings take place just before the grazing season opens, so that details of a cooperative range program can be worked out in the light of the prevailing range conditions. The business transacted includes such matters as the determination of pro-rata assessments for the cooperative purchase of salt, the cooperative hiring of range riders, and the cooperative maintenance and construction of range improvements. Forest officers and range permittees discuss range-management plans. There is always good attendance, because each member of the association has a vital interest in the matters to be determined. The number of local livestock associations in 1937 totaled 741. On many ranges the associations themselves carry out the approved range-management plans.

Rehabilitation of Forest Tenants

Similar policies apply to other forms of national-forest use. The one just described has been developed principally in the western national forests. In the East, where the national forests are more densely populated, democratic processes have been launched with somewhat different ends in view. One important objective is the

rehabilitation of tenants on national-forest lands. Land purchases in national-forest areas have given the Government possession of homes still occupied by the former owners or tenants of the land. These people commonly live by small farming operations, necessarily supplemented by part-time forest or outside work. Often the wise and humane program is to leave them where they are until better opportunities can be provided. As tenants of the national forests, they may improve their standards of living with some aid and guidance, coupled with work on forest-protection and improvement projects.

In this move toward effective economic democracy, the first steps are practical and utilitarian. In many areas once forested the wood-using industries that formerly provided a market for local agricultural products, and also some employment, have disappeared. Accordingly, while restoring this misused resource, the Forest Service in cooperation with the Farm Security Administration is improving sanitation and housing, getting families started in balanced food production for their own tables, and providing part-time jobs in forest work projects. The next procedure is to develop cooperative undertakings of various kinds, particularly in small forest industries. As the family income rises, funds become available for community services and institutions, and these provide an additional incentive for the expression of local democracy. There are few localities, however, in which matters have progressed to that point as yet.

Needs of Forest Dwellers

As a forest landlord, the Forest Service repairs, renovates, or rebuilds farm structures as it is able to do so. The average cost in South Carolina, for example, has been less than $200 per site, with labor, materials, and supervision included. Then comes certain land-improvement work such as terracing and fencing to prevent and control erosion and regulate the use, followed by farm- and home-management plans in which the Forest Service will enlist the cooperation of the Soil Conservation Service, county agents, Extension Service, home demonstration agents, and the Farm Security Administration. With the information then in hand the Forest Service determines an equitable rental policy based on the actual earning power of the land. Credit facilities to permit borrowing for current farming, household and farm equipment, and livestock may then be opened up through the Farm Security Administration. Related activities include surveys of work opportunities available to the tenant population of the national forests, and the establishment of new local industries. Funds available suffice only for limited operations, but the experience already obtained indicates the soundness of the policy.

Democracy in Soil-Conservation Districts

Another promising development in economic democracy is the creation of soil conservation districts. Congress pointed the way in the Soil Conservation Act of 1935, which authorized the Secretary of

Agriculture as a condition to the extension of benefits under the act in any State to require the enactment of State laws providing suitably for erosion control. This Department drafted a standard State soil conservation districts law, in cooperation with representatives of a number of States, in the hope that it would serve as a basis for the enactment of approximately uniform State conservation legislation.

In 1937, 22 State legislatures adopted laws along the indicated lines. These are Arkansas, Colorado, Florida, Georgia, Illinois, Indiana, Kansas, Maryland, Michigan, Minnesota, Nebraska, Nevada, New Jersey, New Mexico, North Carolina, North Dakota, Oklahoma, Pennsylvania, South Carolina, South Dakota, Utah, and Wisconsin. Early in 1938 three more States, California, Mississippi, and Virginia, adopted such laws.

By early 1938, 59 soil conservation districts had been organized in 16 States—Arkansas, Colorado, Florida, Georgia, Maryland, Michigan, Minnesota, Nebraska, Nevada, New Mexico, North Carolina, North Dakota, Oklahoma, South Carolina, South Dakota, and Utah.

Soil conservation districts set up under these laws will be useful for other purposes besides erosion control. They will aid flood control and the retirement of submarginal lands from cultivation and grazing. Also, they will facilitate grazing regulation on private and public lands, and supplement rural zoning ordinances. In all these respects the conservation districts laws will promote economic democracy. As a means of erosion control, soil conservation districts may purchase submarginal lands and keep them in grass or timber. They may regulate grazing, and may supply needed land use control, within zones established under zoning ordinances. Moreover, the laws facilitate cooperation between Federal and State agencies in land treatment for both erosion control and flood control.

The standard act and the 25 laws now in force, which have been modeled on it, are permissive and not mandatory. They authorize farmers to organize soil conservation districts, which will have power to cooperate with farmers in soil conservation work. Such districts may establish land use regulations only after the farmers and the landowners and occupiers themselves have approved them by referendum vote. Once approved, the regulations become binding on all the lands within a duly constituted soil conservation district. As a safeguard against hasty action, there are provisions for notice, hearing, referenda, administrative appeal, and judicial review. Not only may no specific regulations be imposed in a district without a favorable referendum vote, but the district itself cannot come into existence until a majority of the land occupiers within the proposed boundaries have signified a desire for it in a special referendum on that question.

Procedure Under State Laws

In a State that has adopted the necessary legislation, any 25 land occupiers may petition a State committee for the establishment of a district. The term land occupier means any person or corpora-

tion holding the title to land, or occupying it either as owner, lessee, renter, or tenant. On receiving a petition, the State committee holds a public hearing, for the purpose of determining whether a district is needed in the locality and of defining the proposed boundaries. Next it submits the proposal to all the land occupiers within these boundaries. No district can be established unless approved by majority vote, and in some States by a two-thirds vote. Each district thus brought into existence has a board of five supervisors, two of them appointed by a State committee and the rest elected by the land occupiers of the district. Among other powers the district may carry out erosion-control measures, enter into contracts with farmers, public agencies, and others, give them financial and other aid, buy lands for retirement from present uses, make loans and gifts of machinery and seeds, and recommend land use plans. Funds for these operations will come from two sources: (1) Direct State appropriations, and (2) Federal grants in aid. The districts themselves may not levy taxes or special assessments or issue bonds.

The districts may formulate ordinances prescribing land use regulations, and enforce them after they have been approved by referendum vote. Amendment or repeal of the regulations likewise requires a referendum vote. Regulations may include provisions requiring engineering operations, such as the construction of check dams and terraces, and requirements for particular methods of cultivation such as contour cultivation, strip cropping, and the planting of trees and grasses. When land occupiers disobey the regulations, the supervisors of the district may file a petition with the local courts asking enforcement action. Refusal by any land occupier to comply may warrant the court in ordering the necessary work to be done and in assessing the costs against him. Each district has a board of adjustment, with power to authorize variations from the rules when their strict application would cause great practical difficulties or unnecessary hardship. The laws do not authorize any governmental agency to regulate farming, ranching, or lumbering, but simply permit the land operators themselves to adopt whatever regulations they deem to be in their own interest and in the interest of the general welfare. In short, they apply the democratic principle to economic problems of general concern.

Rural Zoning by Local Governments

Still another means of economic democracy in land use is rural zoning, through the permissive action of local governments. Such zoning depends essentially on local willingness to regulate the use of land. It invokes the same principle that the cities employ to control the use of private land for the safety, health, and welfare of the general public. Wisconsin was the pioneer State in this field. All counties in Wisconsin received the power to zone land outside incorporated places through a State enabling act passed in 1923. An amendment adopted in 1929 permitted the zoning of land for agriculture, forestry, and recreation. Several other States, including

California, Indiana, Michigan, Pennsylvania, Virginia, and Washington, have rural zoning laws, through which local communities may control and direct the flow of agricultural settlement, and prevent settlement where it may involve excessive costs or be undesirable for other reasons. Rural zoning can be very effective in controlling the future use of abandoned farm land, which is extremely subject to undesirable resettlement in times of depression. Negatively in checking bad land uses, and positively in stimulating good uses, rural zoning has an important and growing place in agricultural land planning. It is practical economic democracy.

In successful rural zoning the mainstay is local action based on local democratic processes. This is necessary to guard against the imposition of unreasonable or unworkable restrictions on the use of land, and to ensure active local support of whatever regulations may be adopted. Zoning ordinances require more than simply passive local acceptance; they require the active and practical interest of the local community in their administration. With the requisite local backing, such ordinances may harmonize individual, group, and public interests for the achievement of very important land use objectives, such as the prevention of unwise settlement, the preservation of natural beauty, the conservation of soil, water, and vegetation, and the reduction of public expenditures. Without such backing, they quickly become a dead letter. In Wisconsin local action under zoning ordinances has reserved more than 5,000,000 acres for forestry and recreation. By their own decision local people have subjected themselves to numerous land use regulations, which involve considerable individual sacrifice for the sake of an ultimate social benefit. It would be difficult, at any rate in this country, to accomplish similar ends through nondemocratic processes.

Wider Scope for Zoning

In one form or another rural zoning may prove desirable far beyond its present limited range. In the Great Plains benefit from other land use measures may prove transitory without zoning. Several rainy years may follow the drought years, and tempt farmers back into dry farming. They may again try methods suited only to a humid region. This will frustrate the dust bowl program. Obviously, if settlers there may farm exactly as they choose, the next prolonged dry period will mean renewed distress, and another epidemic of disastrous dust storms. Local self-government for better agriculture, through soil conservation district programs and rural zoning ordinances, seems as well adapted to the semiarid Plains as it does to forest cut-over regions.

DEMONSTRATION AND RESEARCH IN SOIL CONSERVATION

The Department provided direct help through the Soil Conservation Service during the year to farmers in dealing with soil erosion, floods, and related problems on a community basis. The Service

aided 34 newly organized soil conservation districts in surveying erosion problems and in planning and putting corrective measures into effect. These 34 districts include an aggregate of 17,870,000 acres in 9 States. Also, the Service conducted soil conservation demonstration work in representative agricultural areas throughout the country. It is the Department's policy to shift emphasis as rapidly as possible from land use activities of a purely educational nature to cooperative work with organized farmer groups, but it will maintain demonstration projects for their educational and research value.

Such projects show the benefits of conservation and interest farmers in land use problems generally. The plan is to continue the projects for 5 years from the time they were started, and make them into permanent, large-scale exhibits of conservation methods. Eighteen new private-land demonstration areas were established. This increase brought the total number of such projects to 166, and extended the aggregate area covered by them to 11½ million acres in 45 States. By the end of the year, 111 of these projects were being conducted on a maintenance basis. The necessary planning and construction work had been completed, and land-treatment plans were being put in operation.

This demonstration work on private land exercises a noticeable influence on land use practices. Many farmers voluntarily adopt conservation practices after seeing them in operation. Measures such as terracing, strip cropping, the use of seasonal cover crops, contour tillage, and so on, have come into wide use since the demonstrations were started. The Soil Conservation Service maintains demonstration areas on certain relatively small watersheds. On privately owned land it requires soil- and water-conservation measures that are likely to be effective, economically sound, suited for use by the average farmer, and capable of showing results within a reasonable time. Primarily the changed physical pattern and soil conservation on the watershed must prove what can be accomplished over larger areas by farmers themselves with the means available.

The Coon Valley Demonstration

The Coon Valley demonstration area, which comprises a natural watershed of approximately 90,000 acres near LaCrosse, Wis., was the first to be established. It is now entering its fifth and final year under the supervision of the Soil Conservation Service. This valley was settled less than 100 years ago. Vegetation covered the gently rolling to rolling upland originally, and dense stands of timber covered the steeper slopes. Marsh hay and grasses clothed the narrow valley bottoms. Small tributaries into Coon Creek had their source in springs that ran throughout the year. Floods were unknown and the early settlers stacked their hay along creek banks. About 1844 clearing of slopes and plowing of lowlands began. From 1860 until about 1880 the settlers raised wheat as their most important crop.

The first flood ever recorded in Coon Valley came in 1873. Grain gradually gave way to livestock in the valley. There was serious overgrazing of pastures, of the remaining timbered areas, and of farm wood lots.

In 1934, when the Soil Conservation Service began operations in the area, Coon Valley was one of the most seriously eroded watersheds in the United States. Hundreds of acres had been ruined outright for further agricultural use by gullying and loss of topsoil. Sand, coarse gravel, and boulders had been strewn over once fertile valley land by the rush of water off denuded slopes. Residents expected a destructive flood at least twice a year.

The Soil Conservation Service asked farmers in Coon Valley to cooperate in a demonstration of soil- and water-conservation practices on a watershed basis. More than half the 800 farmers in the valley entered into 5-year cooperative agreements under which the Service provided detailed land use and conservation plans for each farm, and furnished equipment, some of the labor, and some of the materials for erosion-control measures. The cooperating farmers provided additional labor, equipment, and materials and agreed to follow conservation plans for at least 5 years. They reshaped their fields, retired eroding acres to grass, timber, or other soil-holding vegetation, restricted grazing on critical areas, reduced the acreage of crops that encouraged erosion, and took steps to bring wildlife back.

The result was a great transformation in the valley. Almost 42,000 acres of the land placed under agreement with the Soil Conservation Service have been safeguarded from erosion by various soil- and water-saving devices. Some 11,800 acres are contour-tilled. Strip cropping and contour cultivation protect more than 8,000 acres of erodible cropland. Soil-conserving crop rotations are in use on practically all of the 18,000 acres under cultivation. Approximately 2,000 acres of cropland are being retired to pasture, woodland, or other protective uses. More than 175 miles of terraces on the hillsides retard the surface run-off.

Farmers Cooperate Independently

As the project developed farmers who did not cooperate in it began to adopt conservation measures independently. Fully one-third of the noncooperators are now using various demonstrated conservation practices. The full effect may not be realized for another decade. Already, however, there are visible evidences of future soil stability. Gullying has been permanently checked, and fertile topsoil held on sloping fields. Muddy streams have begun to clear. Trout and other game fish were caught along the lower reaches of Coon Creek this year for the first time in more than two decades. The flood hazard has been greatly reduced. Residents attribute the control of headwater streams to terracing, strip cropping, contour farming, and other water-retarding practices. Nearly all the cooperating farmers have asked the Soil Conservation Service to continue the project after the first 5-year period.

Survey activities become more important as the Soil Conservation Service broadens its program. Detailed conservation surveys were under way in 22 soil-conservation districts by the close of the year. Mapping had been completed on more than 1,000 square miles. Detailed surveys had been made of an additional 9,434 square miles in 24 States as part of the regular survey work of the Service, as well as surveys of 9 demonstration and Civilian Conservation Corps camp areas. General and detailed surveys make possible a more accurate appraisal of the degree and extent of erosion damage.

Preliminary examinations of major watersheds are under way to determine what part upstream land treatment can play in lowering downstream flood crests. In this work the Soil Conservation Service cooperates with other agencies of the Department. It helped in preliminary flood-control surveys on many watersheds. In all these activities the Service develops working relationships along entirely democratic, cooperative lines with the individual farmer and with interested State and Federal agencies.

WILDLIFE AREAS IN LAND PROGRAMS

Wildlife conservation has a bearing on land uses almost everywhere. It has economic, social, and recreational importance. There is a growing disposition to protect birds and other animals for their esthetic value. In conservation usage the term wildlife refers to wild birds and mammals that are of value to man. The annual value of wildlife has been estimated for humid districts of the United States at about 14 cents an acre for meat and fur production, and 22 cents for the destruction of insects and other agricultural pests. For arid regions the corresponding valuations are 4 and 13 cents, respectively. Fish production has been rated at 44 cents an acre of fresh water. Even the recreational values may be appraised; for they are worth what people will pay for them. Recreational expenditures based on wildlife attractions, such as the expenditures of hunters and fishermen and of vacationists and tourists, run to large totals annually. Expenditures of hunters annually for license fees, and for transportation, board, etc., have been estimated conservatively at $25 a man; they have aggregated more than $150,000,000 in some years. Crediting only a tenth of the expenditures of tourists to the drawing powers of wildlife yields an even larger sum. Wildlife is worth some hundreds of millions of dollars annually to the people of the United States.

Every State has passed laws regulating the taking of game species. These laws protect most wild animals for the greater part of the year, and not rarely for all of it except in an open season of only a few days. The purpose is to provide an undisturbed breeding season for all species, and to protect them against undue depletion. Not only game animals, but fur bearers have legal protection. Laws relating to the fur animals are steadily being improved. Song, insectivorous, and game birds receive comprehensive legal protection. The

most important single step in their protection was the ratification of a treaty for the protection of migratory birds in the United States and Canada in 1916. A similar treaty between the United States and Mexico in 1937 greatly enlarged the scope of Federal bird protection. These international agreements protect migratory game birds, insectivorous birds, and other nongame birds, mainly for economic but also for esthetic reasons. Wildlife plays a negative as well as a positive role in the scale of values. There are injurious, as well as neutral and beneficial forms. It is necessary to control the noxious species.

Restraint in Hunting Essential

Legal protection does not prevent a reduction in the numbers of some forms of wildlife, particularly waterfowl. The success of any waterfowl-conservation program depends vitally on proper restraint in hunting. In some sections the hunters increase faster than the conservation machinery, and the demand for hunting privileges may exceed the game supply. As a measure of protection, drastic shooting regulations have been in effect for the past 3 years. The results with migratory waterfowl are favorable. Investigations in Canada, Mexico, and the United States revealed an increase this year in ducks and geese, attributable directly to administration of the hunting laws and development of the refuge program.

Man competes with wildlife for land—for the range that wildlife must have to exist at all. Man cuts the forests, plows the prairies, and drains the swamps and marshes. These activities reduce the habitable range of wildlife. Usually inevitable and economically sound, they are not invariably so. Often they injure wildlife with small or temporary advantage to man, or no advantage to him at all.

It is better to leave marginal lands to wildlife. In certain sandy areas, in muck lands, and in arid regions, the natural crops of vegetation and wildlife may be worth far more in the end than any farm crop that could be raised there. Old fields now waste and once hopeful farmsteads now in ruins are impressive evidence. Ill-advised land utilization injures the land, ruins families, and changes natural conditions for the worse—often irreparably. It robs wildlife, sometimes permanently, of territory necessary to its existence.

Utilization of its native range for dry farming and for grazing domestic livestock nearly exterminated the antelope. Wildlife conservation came to the rescue, and many of these animals are now in sanctuaries. Even on the open range, they get better consideration. But they will always need help to survive. Canvasback ducks long were the greatest prize both of the duck hunter and of the epicure. They bred chiefly in the marshes of the northern Plains area. These marshes have since been largely drained and converted into wheat farms. If we do not restore some of the breeding areas, the canvasback may never be more abundant than it is now. Egrets have been saved from extermination; but they must have wooded swamps

for nesting. Some of the largest swamps of the Southeast should be preserved as egret sanctuaries; otherwise these birds may soon decrease again.

Farming Restricts Wildlife Range

Farming has greatly restricted the range of the prairie chicken. The only hope of saving this bird is to give it better protection and sufficient areas for nesting. Elk in the Yellowstone National Park have satisfactory summer range in the mountains, but they must leave the mountains in the winter. Their original winter range has been taken up for ranches. Accordingly, winter feeding by the Government is necessary to save the elk from starvation. There is a movement under way to insure adequate winter range for the elk, and it may succeed. Beavers have been pursued nearly to the point of extermination. Colonies have been reestablished, however, and the beaver-conservation program promises moderate success. It depends on the maintenance of appropriate grounds for beaver colonies.

Wise and unwise land uses combined have so altered the face of the land that many forms of wildlife retain only a small fraction of their former range. This is evident in former marsh and swamp areas, which drainage greatly changes. In recent years, drainage operations have been used for mosquito control. The Bureau of Biological Survey urges the protection, whenever it is feasible, of wildlife habitats from the destructive changes that result from the drainage of ponds, swamps, and marshes. Mosquito control is essential in densely populated areas, but drainage may not always be advisable. Recent cooperative research by mosquito-control workers and wildlife conservationists has indicated that wildlife conservation and mosquito control can frequently be correlated with small loss to either interest. Drainage has seriously affected muskrats and waterfowl. In some areas it has lowered the ground water so much that the shallower depressions will no longer hold water, and the marshy conditions necessary for wild-fowl breeding cannot be restored.

Sometimes marshes can be restored by damming drainage ditches. This aids in flood control and furnishes homes again for wild fowl and fur animals. Plowed prairie may dry up and blow away; in certain areas we should return it to grass, in which use it will furnish pasturage and support quail, prairie chickens, rabbits, and other valuable wildlife. Lands unwisely cleared of forest growth can be managed to reproduce both timber and wildlife. In these uses they will often produce more income than in farming.

Restoring Wildlife and Soil

We benefit wildlife as well as land through soil- and water-conservation. Planting shrubbery on terrace banks and in ravines, setting out trees for windbreaks and wood lots, and improving the vegetative cover in other ways, are means toward this twofold objective. Such vegetation protects the soil and many wild creatures simultaneously.

It is often necessary, for the sake of the birds and mammals, to reserve certain areas for wildlife. Fortunately, the allotment of land for the use of wildlife began decades ago, and has made considerable progress. This use of the land often favorably influences other uses, notably through the contribution it makes to soil- and water-conservation over large areas.

The first national bird reservation (Pelican Island, Fla.) was created by Executive order in 1903. Executive action in 1909 created the Mount Olympus National Monument in Washington for elk and the Fire Island Reservation in Alaska for moose. By 1926 there were 12 national game refuges in the national forests, comprising 1,199,000 acres; 7 others in military national forests or parts thereof comprising 164,000 acres; 72 Federal game and bird refuges aggregating 489,000 acres administered by the Bureau of Biological Survey; 19 national parks, all wildlife sanctuaries, totaling 7,562,000 acres; 18 national monuments, 471,000 acres; and 22 military, naval, and fishery reservations adding a further 41,000 acres.

Federal activity in reserving lands for wildlife has increased in recent years. Wildlife refuges under the jurisdiction of the Biological Survey in 1938 numbered 248, including 10 maintained primarily as big-game preserves. The area of those within the United States, which number 232, is 7,557,221 acres. State governments and both national and local conservation societies have cooperated. Federal and State reserves in 1933 numbered about 1,300. The National Association of Audubon Societies in 1933 had 110 island, lake, and marsh or swamp sanctuaries. In 1935 an easement program was inaugurated to supplement the major migratory-waterfowl refuges. Approximately 80 units are now in process of development in 5 of the northern Great Plains States. Recognizing the place of wildlife in a sound land use program, Congress enacted the Pittman-Robertson Federal aid in wildlife restoration bill. Under this act, available funds are to be apportioned among the States for the selection and development of waste lands now serving no useful purpose but suitable for wildlife propagation.

Control of Wildlife Harvest

The restoration, development, and maintenance of land for wildlife purposes must be followed by proper control of the annual harvest of the wildlife using the land. This is necessary if the areas set aside are to serve the best recreational, esthetic, and economic purposes. Most of the reserved areas, however, afford protection only, and merely nominal protection where wardens are not employed. There is a vast difference between the mere protection of wildlife and its wise management. Refuges must be properly guarded and wildlife efficiently handled. Better results from reserved areas require an improved and more general combination of protection with management.

The National Park Service conducts wildlife management in all of its holdings. The Forest Service maintains a Division of Wildlife Management, and cooperates with the Bureau of Biological Survey in wildlife-management projects. Examples of this cooperative work are the control of snowshoe hares on forest-planting areas in the Lakes States and control of the deer population on the Kaibab National Forest of Utah. Other cooperative projects deal with the effects of wildlife on timber-stand improvements in eastern forests and wildlife management in the Superior National Forest in Minnesota.

In cooperation with State conservation commissions and the American Wildlife Institute, the Biological Survey has organized wildlife research units in 11 States. Definite progress has been made in determining the relationship of wildlife to agriculture, forestry, and other land uses.

The big-game preserves administered by the Biological Survey have complete wildlife service. Reservations created by separate acts of Congress, including the Upper Mississippi River Wildlife and Fish Refuge and the Bear River Migratory Bird Refuge, have full supervision. All sanctuaries established under the Migratory Bird Conservation Act of 1929 have trained refuge managers. All of these as well as all major waterfowl refuge units otherwise established under the Biological Survey have both supervision and wildlife management. In short, the Bureau of Biological Survey applies management principles to the extent that the available funds and personnel permit.

SOME EFFECTS OF TECHNICAL PROGRESS

It is necessary in agricultural planning to consider the implications of technical progress. Technological improvement tends to provide more goods, to furnish goods more easily or cheaply, or to produce new types of goods. In agriculture, besides making two blades of grass grow where one grew before, it produces one or more blades where none grew before. Agricultural efficiency is the combined result of many things—mechanization and engineering, plant and animal breeding, soil building and erosion control, disease and insect control, marketing, and finance. It depends also, to be sure, on social, political, and legal institutions. As a matter of fact, the social framework or setting is as important as the technology itself. Such improvements as the general-purpose tractor, the refrigerated motortruck, hybrid seed corn, and synthetic fertilizer would be unusable in a backward or disorganized society.

Accurately to measure the results of technological progress in agriculture is difficult if not impossible. Technology reduces the manpower necessary to produce a given amount of food or fiber; but we cannot tell by exactly how much. The proportions of the production factors that technology substitutes for labor on the farm change continually. Machinery and other capital goods replace farm labor.

Also, they displace it, in the sense that they transfer certain activities from the farm to the urban community. Hand labor on the farm gives way to city labor employed in the production of machinery. But the shift is not wholly a net saving or elimination of labor.

Nor can we measure technological progress accurately in terms of farm production per acre. Yields of cotton, tobacco, and late potatoes have increased somewhat or held their own in recent years; on the other hand, the yields of corn, wheat, oats, barley, rye, and hay have slightly declined. The weather affects different crops in different ways. Moreover, new and less productive acreage comes into the average and depresses the yield for the country as a whole. Recent developments such as hybrid seed corn and soil defense have not yet been reflected in average yields. Naturally the volume of production is not the measure of technological progress, because over a term of years it varies with the demand. In fact, technological progress, since it increases the dependability of production, may help farmers in regulating their output when the demand declines.

Little Change in Total Volume

In total volume our agricultural production shows little net change for the entire period 1919 to 1937. From 1919 to 1926 there was a slight uptrend; thereafter the trend was slightly downward. Separate groups of farm commodities showed offsetting trends. Grain production declined, while the production of truck crops about doubled. Production of fruits and vegetables generally rose substantially. The production index for livestock and livestock products showed an increase, as the result mainly of increased dairy and poultry production. There was not much change in the production index for meat animals. Production in agriculture should be distinguished from production capacity. Our farmers can produce all the market will take, and still have land, labor, and machinery to spare, though by comparison with manufacturers they use their resources liberally.

Ideal conditions would permit maximum employment of the farm-production capacity, consistent with good land use and soil conservation. There would be no unemployment of natural, human, or technological power; no disparity between the capacity and the output. How far below capacity our production is now we do not precisely know; but the gap is wide. This is evident from the decline in the foreign demand which has obliged farmers to divert a considerable acreage to soil-conserving crops. Our crops this year, some of which are superabundant, will oblige us to keep still more production capacity latent next year. Two things, neither of them yet in prospect, are necessary to close the gap between production and production capacity in agriculture: (1) A great increase in the demand for agricultural products; and (2), industrial expansion on a scale sufficient to absorb the surplus rural population, and give more scope to farm technology. It may be years before we reach such an adjustment. Meantime, technical progress

in agriculture will lag, and farm manpower will work at less than maximum efficiency.

Advantages Distributed Unequally

Agricultural technology distributes its advantages unequally. It favors the landowner more than the tenant, and the farmer with capital more than the farmer without capital. This is because normally it increases the opportunities for the profitable employment of agricultural capital. True, technological progress often puts new facilities at the disposal of the man on the small poor farm; but not in the same proportion as it makes them available to the wealthier, better-situated farmer. In the absence of counteracting forces, such as the A. A. A. programs, farm-credit relief, and farm-rehabilitation work, technology would concentrate commercial agriculture in units considerably larger than the present average, and subject the independent family-sized farm to severe competition. More efficiency on some farms would drive others out of commercial agriculture altogether. The same technology that gave us more efficient commercial farms would give us an increasing peasantry; that is to say, a rural group condemned to work inefficiently, to produce little for sale, and to buy little from the towns.

Moreover agricultural technology often benefits the nonfarmer more than it benefits the farmer. In the Middle Ages in England it took several days of city labor to buy a bushel of wheat. In the United States in 1840 it required 6 hours. In 1930 it took only 1.3 hours. Uncontrolled farm technology, in the presence of effective technological controls in urban industry, diverts the lion's share of the advantage to the consumer, and the problem of distributing the gains more equitably both within agriculture and between country and town demands attention urgently. Concerted crop adjustment is a partial answer.

In short, the situation we are in indicates great social waste. Technology in agriculture awaits the "green light" of industrial recovery, so that the release of agricultural labor will not mean human suffering. Under the prevailing conditions, the labor released from agriculture moves either toward the congested cities and relief agencies, or toward noncommercial, low-pressure types of farming. That is saving labor merely for the scrap heap. The problem is a standing challenge. Labor should not be sacrificed ruthlessly to the technological process, but saved for new and better uses. Agriculture's contribution to this end is to divert agricultural energy from the production of surpluses to the defense and upbuilding of the soil, to the conservation of forests and wildlife, and generally to the maintenance of the productivity along with the actual current production of the farms.

Battle Against Nature's Destructive Forces

Farm technology has a relatively unimpeded field in the struggle against the destructive forces of nature and of improper land use

methods. Employed against soil depletion and soil erosion, against plant and animal diseases and insect pests, and against adverse weather conditions, it is clear gain. Even in the most unfavorable market conditions, it pays to produce crops and livestock at the lowest possible unit cost, and to protect the physical body of the soil. There is less room at present for using technology to increase the volume of production and to bring new land into cultivation. Nearly all technical progress in agriculture tends, in the long run, to increase production and market supplies; but it can be applied so as to delay this result, and to emphasize farm improvement, lower costs of production, and better land use. It would be grossly inefficient to give science a holiday and let diseases and pests take the crops. But agricultural technology has power to swamp the agricultural markets. We must apply controls to it, pending the industrial and business improvement which alone can give it full release.

Some agricultural areas face serious adjustment problems as a result of recent technical changes. Agronomists estimate, for example, that by 1945 hybrid corn will enable Corn Belt farmers to increase their corn yields by approximately 20 percent above the rather high yields of 1920. It would not help the individual farmer to reject hybrid seed corn; yet, when thousands of farmers use it, the aggregate increase in the supply seriously affects them all. Crop adjustments will be desirable to shift poorly adapted cornland to other crops. Moreover, the effect of greatly increased corn yields in the Corn Belt will not be confined to that region. They will cover dairy and meat production as well as grains and other crops. Increased facility in corn growing will necessitate better control of the total corn output. There is no other way to cushion the shock of the readjustment.

Similarly, we face an increase in the production of other feed crops. Recently the Bureau of Agricultural Economics studied the probable effects of agricultural conservation on livestock production in selected areas in the Midwest dairy region. On the basis of certain assumptions the study indicated a probable increase of nearly 5 percent in available feed nutrients. Principally, the study assumed full participation by the farmers in the program, and a shift from corn and oats to alfalfa and other tame hay. It took no account of the yield increases that may result from the conservation of the soil. Allowance for these also would give an increase in the production of feed nutrients by 1945 of about 10 percent. As a matter of fact, the conservation program, though tied in with crop-limitation requirements, tends so strongly to increase the production capacity of the farms that crop adjustment becomes more difficult.

Industrial Technology Affects Agriculture

Industrial as well as agricultural technology affects the crop pattern. Recently, for example, great changes have taken place in the industrial utilization of soybeans. Up to 1935, the principal use of

soybean oil was as a drying oil in the paint industry. This use, indeed, has increased slightly since then; but a huge increase in the factory consumption of soybean oil has resulted from an increased demand for it in edible forms. Compounds, shortenings, and oleomargarine account for most of the increase. In 1936 about 81 percent of the soybean oil produced in the United States went into edible products, as compared with only 16 percent in 1914. There are other new industrial uses of soybeans, notably in the automobile industry. These developments have prompted farmers to increase their soybean acreage from less than 2,000,000 acres in 1924 to about 7,000,000 acres. In Illinois, the leading soybean State, the increase has been tremendous—from about 300,000 acres in 1924 to more than 2,000,000 acres in 1937. Industrial technology may increase the comparative advantage of soybeans still more.

Further improvement in the handling and distribution of fruits and vegetables is in prospect. In this field, however, so much has been accomplished already that future developments may be less spectacular. There has been an astonishing percentage rise in the production and consumption of fresh vegetables since 1920. The outlook now is for a declining rate of increase. Nevertheless, we may expect a continued substantial gain, particularly if industrial recovery increases the incomes of consumers. Large portions of the population still have a dietary that is low in essential vegetables. Better marketing facilities and better consumer incomes will bring new areas into vegetable production. On the production side considerable gains will come from the variety work and breeding work of this Department and of the State experiment stations, and from improved farm practices. Much of the improvement will be in the quality of the products. Technological progress in canning and other processing operations, in refrigeration, and in rapid transport may continue to stimulate the fruit and vegetable industry. This will be partial compensation for the decline in agricultural exports. Technology directed toward supplying the American people with a more varied diet rich in the protective foods harmonizes perfectly with farm-adjustment needs.

Technology and Better Quality

In the main, however, technological improvement causes the production capacity of our farms to increase faster than the market. Formerly, the market at home and abroad absorbed the commodity results of technological improvement readily. That is no longer true. Export trade takes less of our production than it once did and home trade expands less rapidly. As our population growth declines the agricultural adjustment problem becomes more difficult. It is imperative to emphasize quality rather than quantity in the application of farm technology. The problem is to grow a better blade, rather than two blades, where one grew before. It is not a problem for the farmer alone, because the solution depends obviously on the consumers' ability to pay for a better and consequently more expensive diet.

This is one alternative to the indefinite contraction and impoverishment of agriculture. As the foreign market declines, agriculture must have compensation at home. This can come partly through increased total domestic consumption for we still have undernourished people; but the main enlargement in the home demand must come from an increase in the spending power of the individual consumer. There is more scope in that direction than for increased per capita consumption. With consumer incomes higher, farm technology can be devoted to producing better-quality products, and also to producing more of the more expensive items in the national dietary, such as dairy products, meats, and fruits and vegetables. Progress may continue indefinitely along this line. Improved consumer buying power is our best reliance against the undoubted tendency of technical improvement to glut the markets, the bread lines, and the subsistence farms.

DISCUSSION GROUPS CLARIFY FARM PROBLEMS

Some of the questions that farmers ask more and more are the very general ones: What is the whole farm program about? and What is it getting us into? As farmer committeemen begin to master the technical phases of their job, they ask questions more insistently. In an effort to meet this demand, the Department has set up a section to acquaint field workers of the Extension Service, and farmer committeemen, with the social implications of the farm program. Lecturers from the staffs of colleges and universities address discussion groups at meetings held in rural communities throughout the country. There are also meetings without lecturers at which the discussion groups debate rural problems, with such help as the Department and the State colleges of agriculture can give them through pamphlets, discussion-leader training, and community organization.

Such schools for extension workers have been held in 22 States with an average attendance of 125 persons. Eight States have held repeat schools, with an average attendance of 230, including farmer committeemen, farmers, and farm women. Schools will be held in eight more States within the next 6 months. A staff of five or six men is assembled for each State school. It includes college professors of philosophy, psychology, education, economics, sociology, and political science. Uusually the schools last 4 days. They are generally held at the State college of agriculture.

The most popular topics have been: The backgrounds of the present farm situation, foreign affairs, the relation of Government to social and economic developments, and social adjustments. In the repeat schools, the topics are usually more specific. Examples are: Increasing the farm income, keeping the young folks on the farm, agriculture and industry, rainfall and the water table, rural arts and crafts, farmers' cooperatives, land utilization, county planning, etc. Field workers return to their jobs with a better understanding of what they are doing, and with a new sense of their responsibility in

the administration of the farm program. The lecturers, who come largely from colleges and universities, gain knowledge of the farm problem direct from farmers.

Group Leaders for Each State

There is a discussion-group leader for each State appointed by the State director of extension. This leader cooperates with representatives of the Department in organizing discussion-leader training groups. Over a hundred such leadership-training groups have met in some 35 States. The next step is the organization of local discussion groups of 15 to 20 persons. Most of those who attend the schools become discussion-group leaders in their local communities. Sixteen subject-matter pamphlets have been prepared by the Department, with bibliographical lists, to provide materials for group discussion. Additional materials have been prepared by the States. Over 2¼ million copies of these pamphlets have been distributed. National farm organizations, rural ministers' associations, vocational agriculture leaders, and other groups have cooperated in extending this method of adult education among city as well as rural folks.

This study of the farm programs is strictly educational. It deals with the broader phases of the agricultural situation, and enlists the active interest and participation of those who attend the meetings. Members of the Department's field force, and farm men and women, learn to see the general relationships as well as the particular aspects of their own participation in the farm programs. From 80 to 90 percent of those who attend the schools usually engage in the discussions. This smooths away misunderstandings, and fits the conferees for more intelligent leadership in their local communities.

FARM INCOME, PRICES, AND PRODUCTION IN 1938

After 4 successive years of rising farm prices and farm incomes, the last half of 1937 and the first half of 1938 brought reduced farm prices and reduced farm incomes. By midsummer of 1938 the prices received by farmers for their products had declined about 25 percent from the level that prevailed in the summer of 1937. Cash farm income with Government payments to farmers in 1938 may be about $1,000,000,000 less than the corresponding combined total of $8,600,000,000 in 1937. This is a decrease of less than 12 percent. All the important products shared in the decline, with wheat and cotton showing the greatest percentage decrease. Nevertheless, the estimated 1938 cash income is greater by about $3,250,000,000 or 75 percent than the cash income received by farmers in 1932.

In 1937 the cash farm income from crops, livestock, and livestock products was slightly more than $8,200,000,000. Farmers also received $367,000,000 from the Government in cash. On the farm and in the farm home they consumed farm products valued at $1,400,-

000,000. Hence, the grand total of their income was about $10,000,000,000, as compared with about $9,300,000,000 in 1936, with $12,000,000,000 in 1929, and with $12,240,000,000 in 1925. Similarly computed the gross income for 1932 was only $5,280,000,000. The index of prices received by farmers in 1937 was 121; in other words, it was 21 percent above the average level for the pre-war period August 1909 to July 1914. In 1936 the index of prices received by farmers was 114, as compared with 65 in the depression year of 1932, and with 146 in 1929. It is well to bear in mind, of course, that farm income does not necessarily vary directly with or in proportion to changes in prices. Farmers often seem to be more concerned about prices than about income, and to get more satisfaction, for example, out of selling 1 dozen eggs at 60 cents than 2 dozen at 40 cents a dozen. It cannot be too strongly emphasized that the cash income from marketings is the combined result of prices and production. As supplies increase, prices decline; but moderate production sold at moderate prices may bring more income than smaller production sold at very high prices.

Prices Paid by Farmers

Another vital element in the farm situation is the level of prices that farmers have to pay for various goods and services. In 1937 this was 30 percent higher than before the war. The prices that farmers received, for a given quantity of agricultural products, purchased only 93 percent as much of the commodities farmers buy as did the money received for the same quantity in the 5 pre-war years. But the ratio of prices received to prices paid by farmers was vastly better in 1937 than in 1932. In the latter year it was only 61. Even in 1929 the ratio was only 95, or just 2 points higher than in 1937. In short, 1937 was a pretty good year for agriculture, from the standpoint both of farm income and of the buying power of farm commodities.

All the important commodities and regions shared in this favorable condition. The income from crops in 1937 rose more than the income from livestock and livestock products. The income from meat animals and dairy products showed the lowest rate of increase; but it had previously been relatively high. Cash income from grains in 1937 was nearly three times greater than in 1932. Income from fruits and vegetables was about four-fifths greater; income from meat animals and from cotton was about twice as great; and income from poultry and eggs and dairy products was about 50 percent greater. The largest percentage increases in the 1937 cash income (including Government payments), when compared with 1932, were in the East North Central, the South Atlantic, and the South Central States. The lowest rate of increase was in the North Atlantic States. Farm incomes in the west North Central and the Western States almost doubled.

In 1938 the situation was less favorable. As already mentioned, the farm-commodity price level in midsummer was about 25 percent

lower than in the summer of 1937. But the prices paid by farmers for commodities bought were only about 8 percent lower. In consequence, the ratio of prices received to prices paid dropped to 75, or to about the level that prevailed in 1934. It was still 23 percent higher than in 1932. Lower prices and farm incomes in 1938 were largely the result of the decline that began in 1937 in industrial activity and consumer incomes. This decline, which continued in 1938, caused a marked drop in the domestic demand for farm products.

Increased production and increased stocks of some crops contributed to the farm-price decline. Accumulated supplies and stocks placed this country on an export basis with wheat and kept the price of cotton from reflecting plainly the prospect for a smaller crop in 1938. As a whole, however, the supply of farm products marketed in 1938 was not greatly different from that marketed in 1937. Increased marketings of corn and wheat and of meat animals and dairy products were offset by smaller marketings of cotton, fruits, and eggs. The supplies of potatoes, tobacco, and rice were about the same as in the preceding year. The estimated farm income for the full year 1938 assumes a moderate improvement in industrial activity and urban incomes during the latter part of the year.

Crop Production in 1938

The October crop report showed a total of 332,825,000 acres of the principal crops for harvest in 1938, as compared with 330.139,000 acres in 1937, and a 10-year average (1927–36) of 333,162,000 acres. The cotton area was about 8,000,000 acres less than in 1937, but this decrease was more than offset by an increase in the acreage of food and feed crops.

The largest increase was in the harvested acreage of wheat, the area of which was about 7,000,000 acres more than in 1937.

The October report showed a larger production than last year of most crops except cotton, corn, and oats, and a production above the 10-year average of practically all crops except cotton. Wheat, barley, hay, and peanuts gave the principal increases.

In cotton there was a sharp reduction from the previous year. The output as indicated in the October report was 12,212,000 bales, as compared with the record crop of 18,946,000 bales in 1937.

Our wheat crop according to the October report was 940.000,000 bushels, the third largest on record. With the carry-over of 154,000,000 bushels of old wheat the new crop raised our supply to about 1,100,000,000 bushels.

The corn crop was indicated in the October report at 2,459.316,000 bushels, as compared with 2,644,995,000 bushels in 1937, and with the 10-year (1927–36) average of 2,306,157,000 bushels. The total supply of feed grain available on farms October 1 was about 100,000,000 tons, as compared with 97,000,000 tons on October 1. 1937, when the carry-over from the preceding crop was small. The 10-year average (1927–36) supply of feed grain was about 90,000,000 tons.

There were good yields of nearly all crops. Though the yields per acre averaged about 8 percent less than in 1937, they were greater than in any other season since 1920, and nearly 9 percent more than the average for the predrought period 1923–32.

Market Situation for New Crops

At the beginning of the marketing season for crops produced in 1938, the situation was about as follows: Larger supplies of wheat, cotton, dairy products, livestock, poultry, and vegetables were in prospect than in several years. Supplies of fruits and of eggs were slightly reduced from the previous season. The level of consumer incomes and of domestic demand was considerably lower than in the second half of 1937 but some improvement was in sight for the fall and winter. Farm-commodity prices were lower than in 1937 for all groups of products, particularly grains and cotton. There was little immediate prospect of any general material increase. Larger supplies of more important commodities seemed likely to offset more or less the expected improvement in the domestic demand.

It seemed likely that the cash farm income would show a gradual increase as the season advanced. There were indications that increased marketing of livestock and of some other products would somewhat more than offset the effect of the lower prices on the farm income. Expected improvement in business activity and consumer demand was an additional favorable indication. It seemed probable that month by month the declines in farm income from the monthly totals of 1937 would give place to actual increases, as the comparisons reflected the lower totals of the later months of 1937 and the first part of 1938. Actually, the situation seemed likely to become more favorable in reality than in appearance. In other words, it seemed likely to produce proportionately more improvement in the farm income than in the price level. The general tendency to interpret agricultural welfare in terms of prices rather than in terms of income frequently obscures basic improvement of this character.

Cotton and grains were in the least favorable position. There was some prospect of increased consumption by domestic cotton mills but the consumption of American cotton by foreign mills showed no evidence of picking up materially. Foreign cotton production for the 1938–39 season will be less than it was for the 1937–38 season. In fact, the decrease seemed likely almost to offset the increase that occurred, because of reduced consumption, in the carry-over of foreign cotton. Our own cotton acreage was about 22 percent lower this year than in 1937, and the October forecast of the crop was for only 12,212,000 bales of 500 pounds gross weight, equivalent to about 12,050,000 running bales. But the world carry-over of American cotton at the beginning of the season was very large. Added to the large carry-over from last year the 1938 cotton crop put the total world supply of American cotton in the running bales at about 25,700,000 bales. This compares with 24,600,000 bales last season, with an average of about 22,000,000 bales for the 5 crop years ended July 31, 1937.

and with 26,200,000 bales in the year ended July 31, 1936. The United States Government was holding more than 7,000,000 bales as collateral for loans to growers. Prices were near last year's low levels. Hence, the income from sales by growers seemed likely to be well below that of recent years.

World Wheat Situation

World wheat supplies (excluding those of the Union of Soviet Socialist Republics and China) for the year beginning July 1, 1938, were about 600,000,000 bushels more than on July 1, 1937. Foreign exporting countries, as well as the United States, had larger crops in prospect. There was evidence that wheat from the United States would meet with keener competition. There was even a possibility that our exports for the crop season would be less than in 1937–38 and that world prices would be lower. This country's wheat crop, one of the largest on record, was about 940 million bushels. Stocks of old wheat in the United States at the beginning of the season were about twice what they were at the beginning of the 1937–38 season. World wheat prices for the 1939–40 marketing year, when wheat seeded in the fall of 1938 will be sold, will probably be relatively low unless world acreage declines or world economic conditions improve materially.

This year's favorable growing weather produced above-average yields on a reduced acreage of feed grains. Indications in September were that the production of the four major feed grains would be only 6 percent below the large production of 1937, and about 6 percent above the annual average for the 10-year period 1927–36. The number of hogs on farms was relatively small. The supply of feed grains per grain-consuming animal in 1938–39 will be lower than it was in 1937–38, but with that exception will be the largest in more than 12 years. Some expansion of livestock numbers is under way and the expected improvement in consumer incomes will increase the demand for meats. This will strengthen the demand for feed grains, though the prices of the latter will probably remain relatively low until feed requirements increase in relation to the feed supply.

Livestock and Tobacco

The situation for livestock and livestock products is more encouraging. The trend of production is upward and seems likely to remain so for several years. Nevertheless, the prices of livestock and livestock products have fallen less drastically than the prices of the leading field crops. It seems likely that the prospective improvement in consumer buying power will offset the influence of the increasing supply of livestock and livestock products on the incomes of producers. Though livestock prices may be lower than in 1937, when slaughter supplies of hogs were relatively small and consumer incomes relatively high, the income outlook for livestock and livestock products is not bad.

Tobacco production in 1938 will be about 5 percent less than it was in 1937. Conditions in the tobacco industry as a whole are comparatively favorable though the prices for some types of tobacco are slightly lower than they were last season. The prices of both fruits and vegetables are down as compared with 1937. This is largely the result of increased supplies available in 1938 and the decline that has taken place in consumer buying power. Vegetable production for the year as a whole will be slightly larger than it was in 1937. The trend in vegetable prices will depend as usual on the weather conditions that affect vegetable production, and still more upon the trend in consumer incomes. In general, it may be said that the outlook for farm income in 1939 is less discouraging than the price situation for many commodities might indicate.

PRICE SPREADS BETWEEN COUNTRY AND TOWN

The American farmer has always been quick to adopt new and improved means that lower his cost of production, such as more efficient machines or higher yielding seed. Adoption of better methods on the farm benefits both farmer and consumer. Yet neither gets the maximum benefit unless the marketing system likewise develops more efficient methods. If better methods on the farm lower the cost of producing wheat by 15 cents a bushel, this ought to mean better income to the farmer and lower bread prices to the consumer.

But if millers and bakers at the same time increase their charges by one-fourth of a cent a pound loaf of bread, without giving more or better service, the added marketing charges offset the saving on the farm, and neither the farmer nor the consumer gets any benefit. Marketing is part of the process of production. If the farmer simply grows wheat and lets it rot, he has not really produced anything. The process of production is not complete until the wheat has been sent to market, ground into flour, baked into bread, sold and delivered to the home of the consumer. We need economies not only on the farm but in the whole process of producing food. They must cover transportation, wholesaling, processing and manufacturing, and retail distribution.

This Department has made several studies of the spread between prices at the farm and prices in retail stores. On the average, the American farmer gets from 45 to 50 cents of the consumer's food dollar. The rest goes to transportation agencies, processors, and dealers. The statistical evidence indicates a tendency for the farmer to get a smaller proportion of the consumer's dollar than he got before the war. Part of this trend may be the result of higher wages in marketing and distribution. If we divide the marketing charges by an index of wage rates, we get a rough index of the man-hours required in marketing. Such an index indicates a decrease for a few years immediately after the World War. It shows practically no change for the period 1922 to 1938.

This does not prove that there has been no improvement in marketing since 1922. Cooperative associations have brought economies into the system; improvements have been made in manufacturing and processing; cheaper methods of transportation have been found; new methods of retail distribution have grown up; and Government services such as market news and inspection have been developed. But why do these changes not show up as decreases in our statistics of marketing costs and charges? One possible answer is that the statistics are inexact, and this may have some weight. Exact comparisons of present price spreads with those of several decades ago is not possible. But this is probably not the main reason for the absence of any indicated decrease in man-hours in marketing.

Consumer Requirements Rising

Consumers constantly require more services of our marketing system. Vegetables once came mainly from market gardens near the consuming city; now they come in large quantities from distant points. Bacon used to be bought in the strip; consumers buy it now in a half-pound package, sliced, and wrapped in cellophane. Milk goes through a process of inspection, pasteurization, and bottling. Services like these are expensive. The added cost may offset most of the savings which have been introduced into the marketing system. Luxury habits and the demand for additional services grow up in times of prosperity, and persist during depressions. They increase the charges between the farmer and consumer.

No one can reasonably object to giving the consumer fancy packages and more services if he wants to pay for them. But if processors, wholesalers, and retailers add expensive things when consumers do not need or want them, the cost will largely fall on the farmer. Consumers should have a chance to buy good food without expensive services—at a price that reflects the savings.

We need to keep our pushcart markets and curb markets. We need more low-priced retail stores, which will handle bulk foods and avoid expensive packaging. We need more accurate labeling and grading so the consumer can buy more intelligently. We need to avoid too much insistence on only first-quality foods. All foods should meet basic health requirements; but thousands of families would rather have grade C food at a low price than grade A food at a high price, and thousands of farmers have grade C food to sell. Our marketing system must efficiently meet the needs of the poor as well as of the rich.

Marketing System Needs Modernization

In the long run the most efficient marketing system will probably result from competition. Regulated monopolies may be the eventual answer in a few industries. Recent studies of the Federal Trade Commission with regard to the processing and marketing of farm products point the way to better methods of regulating marketing

to promote honest practices and effect economies. It is important, however, to guard against laws and regulations that may interfere with the free flow of agricultural products from one State or region to another. The Department is cooperating with other Federal and State agencies in an attempt to work out a legislative program which will adequately protect the farmer, the dealer, and the consumer without adding unnecessary costs and without lessening competition between areas. The marketing system needs modernization. Substantial improvements have been developed in the past, but there is room for more.

THE FOREIGN-TRADE SITUATION

The fiscal year 1938 brought an abrupt reversal in the trends of agricultural exports and imports. In that year our agricultural exports showed a rise, in terms of value, of 22 percent compared with the immediately preceding fiscal year and were the largest since 1930–31. In terms of quantity agricultural exports were 41 percent larger than those of 1936–37.

On the other hand, our imports of agricultural products similar to or competitive with those produced in the United States decreased by almost one-third as compared with 1936–37. It is of particular interest to note that agricultural imports declined steadily throughout the fiscal year 1938. The decline continued into the current fiscal year. This reversal in our foreign trade trends may be attributed partly to the larger crop production of the United States in 1937. In previous annual reports I pointed out that a return to more normal weather conditions in this country would mark the disappearance of the so-called import problem and the recurrence of the export surplus problem. That is exactly what has occurred. Instead of importing wheat and corn we have had large exports of these products. In wheat, exports in the fiscal year 1938 amounted to approximately 100,000,000 bushels and were the largest since 1931–32. In corn, exports did not start until November 1937, when our crop became generally available for market. Nevertheless, exports during the fiscal year totaled 104,000,000 bushels, the largest exports of corn from the United States, with only two exceptions, since 1900. There was a similar tendency toward increased exports of animal products, such as pork and lard, and toward reduced imports of similar products into the United States. This change was more gradual than the change in the annual crops, since it takes the farmers considerable time after increased feed supplies become more plentiful to expand their livestock marketings.

Reduction in foreign grain supplies contributed to the expansion in our agricultural export trade; also the lowering of foreign trade barriers under the reciprocal trade agreement program. Another important factor in the reversal of our foreign trade situation was reduced industrial activity in the United States during the year.

This had more influence on imports than on exports. It affected especially imports of certain raw materials such as wool, which this country has imported regularly for many years.

There have been attempts to connect the larger agricultural imports of the drought years with the reciprocal trade agreements program. If any such connection existed it would have been more apparent in the last fiscal year than ever before, since more agreements were then in effect. As a matter of fact, the reciprocal trade agreements did not cause a flood of agricultural imports. Of our total imports of competitive agricultural products in 1937 (excluding sugar, the imports of which are controlled by quota) less than 9 percent consisted of products on which duties had been reduced in reciprocal trade agreements. In general, the imports of products on which the duties had been reduced increased less during the drought years than the imports of products such as wheat and corn, on which the duties had not been reduced.

Influence of Abnormal Weather Declining

Effects of the droughts of 1934 and 1936 on our foreign agricultural trade are disappearing, and more normal weather conditions have returned. Accordingly, it is possible to view our foreign trade situation in truer perspective. The important problem now, as it has long been, is to find ways and means of disposing of supplies in excess of our domestic requirements rather than to deal with imports of competitive products. Such imports, to whatever extent they constitute a problem, can be readily and easily handled, by an import policy designed to prevent them from becoming excessive. It is not necessary to maintain prohibitive import duties. Our import policy should simply be flexible enough to prevent imports from having a serious depressing effect on agricultural prices in the domestic market.

The export problem is more difficult. World import requirements for wheat are smaller than they were in the 1920's, while the competition of other wheat-exporting countries is as great as ever. For cotton the potential import requirements may not be less and may be larger than in former years. But in certain countries, such as Germany, Italy, and, more recently, in Japan, this potential demand is far from realized and the competition from other sources of supply has increased. One striking development of the last 25 years is the expansion of cotton-textile manufacturing in the Orient. Oriental cotton production will tend to supply a larger part of the Orient's requirements than it did when vast quantities of cotton goods were imported into the Orient.

World import requirements of fruit and tobacco have increased considerably in spite of barriers to international trade. Unfortunately, the position of the United States as a supplier of these products has suffered from preferential duties and other adverse trade arrangements in foreign countries.

Conditions in international trade affect different products in different ways, and necessitate a variety of methods for handling export surpluses. In exceptional circumstances, for example, when other governments energetically encourage the sale of their supplies in restricted foreign markets, the United States Government may have to encourage exports too. Again, the problem may be mainly one of reducing the costs of production and improving the marketing system, so that American products can compete more successfully in world markets. Often the problem is essentially one of high import barriers in foreign countries. This difficulty can best be handled through reciprocal trade agreements.

Foreign Buying Power

One fundamental element in the situation affects all our export trade whether agricultural or industrial. That is the level of foreign purchasing power. Foreigners cannot buy our products if they are unable to obtain dollar exchange. They can get dollar exchange in only three ways: (1) By selling goods and services to the United States; (2) by borrowing money in this country; or (3) by shipping gold to us. In 1936 and 1937, increasing imports of goods and services into the United States carried us toward adjustment of the international balance of payments to our creditor position.

This progress stopped in 1938 with the drastic decline in our imports, the causes of which I have noted. Improved growing conditions for American agriculture made emergency imports of certain agricultural products no longer necessary and increased industrial activity reduced the demand for imported raw materials.

The reciprocal-trade-agreements program is laying the basis for an expansion of our import trade through carefully considered reductions in unnecessarily high import duties. Increased industrial activity, which is already in evidence, will increase our imports of raw materials. Such an expansion in imports will favor expansion in our exports including those of agricultural origin.

THE SUGAR ACT OF 1937

Legislation pursuant to the President's message to Congress dated March 1, 1937, on a proposed sugar-quota system and its necessary complements, took form in the Sugar Act of 1937 (approved September 1, 1937). This legislation provides that the Secretary of Agriculture shall estimate the annual consumption requirements of the continental United States in December of each year, and at such other times as he may deem necessary, and shall allot the estimated quantity as import or marketing quotas among the areas that supply the continental needs. This he must do in accordance with a formula set forth in the act. Only a small part of the Puerto Rican and Hawaiian quotas may be filled in the form of direct-consumption sugar. Quotas may be allotted to persons who market or import sugar, if such action is necessary to insure an adequate and orderly

flow of sugar in the channels of interstate and foreign commerce, to prevent disorderly marketing, or to afford all interested persons a fair chance to market sugar.

In addition, the act provides for conditional payments to producers at a basic rate of 60 cents per 100 pounds of recoverable sugar, raw value. For large producers it requires certain downward graduations in this rate. To qualify for payments, sugar producers must fulfill certain conditions. They include: (1) The elimination of child labor, except that of immediate members of the producer's family; (2) the payment of fair and reasonable wages; (3) the preservation and maintenance of soil fertility; (4) marketing of no more than the farm's proportionate share of the quota and normal carry-over inventory for the area in which the farm is located; and (5) if the sugar producer is also a sugar processor, the payment of fair and reasonable prices for the sugarcane or sugar beets purchased from other producers. There are provisions for acreage-abandonment and yield-deficiency payments to producers in the event of certain natural calamaties, such as freeze or drought.

The Sugar Act provides for the imposition of an excise tax on sugar at the rate of 50 cents per 100 pounds of 96° raw sugar. There is a compensating import tax of like amount. In his message of March 1, 1937, to Congress, the President recommended a tax of not less than 0.75 cent per pound of sugar and stated he had been definitely advised that such a tax would not increase the average cost of sugar to the consumers. During the first year of the act, the retail price of sugar has averaged 5.5 cents per pound, or practically the same as the average price during the year that preceded the enactment of the legislation.

Income of Sugar Industry Maintained

The income of the domestic sugar industry as a whole has been maintained. During the first year of the operation of the Sugar Act of 1937, beginning in September 1937, the wholesale price of refined sugar (net extax) averaged $4.05 per 100 pounds, as compared with $4.671 for the preceding year. However, offsetting the lower net price to the industry, conditional payments at the rate of 60 cents per hundredweight (equal to 64.2 cents per hundred refined basis) were made to producers in the 1937–38 crop with downward graduations for large producers. Hence, the income of the domestic industry, although redistributed as between growers, processors, and labor, has been equivalent to approximately $4.70 per hundred pounds.

The decision of the United States Supreme Court in January 1936 in the Hoosac Mills case (*United States* v. *Butler*, 297 U. S. 1) invalidated the processing tax and production-adjustment features of the Agricultural Adjustment Act. The sugar-quota provisions of the act were not affected by the decision. There resulted a redistribution of the income of the sugar industry to the advantage of processors and the disadvantage of growers. Contracts between processors and

growers ordinarily give the growers about half the net sales value of the sugar processed from the cane or beets sold. The processing tax under the Jones-Costigan Act reduced the net sales value of the sugar which meant a lower price to producers by approximately half the amount of the tax. But the benefit payments more than compensated the growers.

After the Hoosac Mills decision, under which the processing tax and production-adjustment features of the Agricultural Adjustment Act were invalidated, the quota provisions of the Jones-Costigan Act and Public Resolution No. 109, maintained the price to consumers, and the net proceeds from the sale of beet sugar rose by approximately the amount of the suspended processing tax. Under the usual grower contracts, this meant an increase in the price paid to producers of only half the amount of the tax. Growers received this increase, but lost the materially larger benefit payments. Thus the net effect was to give the producers less and the processors more total income. As a result, the earnings of the major sugar-beet processors, stated as a percentage of their net worth, rose to an average level of 12.5 percent for the fiscal year ended in the spring of 1937. A similar redistribution of the income from the sale of raw sugar produced from sugarcane occurred.

Grower Income About Parity

The Sugar Act of 1937 improved the situation for the growers. The 1937 sugar-beet crop, the first to be marketed under the new law, will probably give the growers an income per ton equal on the average to parity prices. The increase in the income to growers from the 1937 crop will average close to $10 an acre over that of the preceding year. Independent growers of sugarcane will benefit similarly. The margin of the processors has been reduced somewhat but they have benefited from increased volume of tonnage, which has resulted in part from the assurance of a more equitable division of total returns. It is significant that the first sugar-beet plantings after the enactment of the Sugar Act have been large enough for the first time since 1934 to justify the expectation that the industry will be able to fill the sugar-marketing quota established for the sugar-beet area.

Briefly, during the first year of the operation of the Sugar Act of 1937, the income of sugar-beet and sugarcane growers was increased and the total income of the sugar industry was maintained despite a decline in the general purchasing power of consumers. Moreover, this was accomplished without the evils of a rigid price structure. It is particularly significant that consumer requirements for sugar were adequately met at varying prices as industrial recession and recovery caused variations in consumer incomes.

The price of sugar at retail declined from 5.7 cents per pound in September 1937 and 5.8 cents per pound in October 1937 to 5.3 cents per pound at the end of the first year's operation under the act. Yet, excluding the tax, the available wholesale price of refined cane sugar

when added to the conditional payments to sugar producers during the same period gave the industry a total income per pound of sugar as already pointed out of 4.692 cents per pound as compared with 4.671 cents the previous year. If price rigidity had been attained through excessively restrictive quotas, the sugar industry would have received an unduly large proportion of the national income. This would have contributed to instability in the social structure.

Under the provisions of the act that permit the reallocation of any deficits in quota supplies of the Philippine Islands to foreign countries other than Cuba, such allocations have been made. As a result, our export trade with certain of the full-duty areas, primarily the Pan American area, may be somewhat increased, and diversified. The excise tax on sugar and on an equal compensating tax under the Sugar Act of 1937 may have resulted in some reduction of the income for foreign sugar and in some increased income to the Federal Treasury.

The President's message of March 1, 1937, to Congress emphasized the desirability of continuing the policy, which was inherent in the Jones-Costigan Act, of preventing child labor and of maintaining wages at not less than minimum standards in the sugar-growing industry. The Sugar Act of 1937 made the necessary provisions for labor. Elimination of child labor has been promoted and the Department established minimum wages as a condition for payments to producers of the 1937–38 crop. These minimum wages represented an increase for each of the sugar-producing areas over wages that had previously prevailed. The increase for harvesting the 1937 beet crop was 10 percent, 8 percent for harvesting in the mainland sugar area in Florida, and 20 percent for Louisiana. In Puerto Rico sugar-crop wages in 1938 were increased approximately 10 percent above the highest standard rates paid by any group of Puerto Rican producers in 1937. The increases for work done in the Hawaiian sugarcane crop between September 1 and December 31, 1937, varied for different branches from 5 to 20 percent. Similar requirements are being established for all producing areas for the 1938–39 crop.

Some Difficult Problems

Administration of the Sugar Act raised a number of difficult public questions. They related principally to (1) the extent of the protection that should be accorded to the industry as a whole and to its constituent elements; (2) the appropriate standards that should be applied in determining fair and reasonable wage rates for agricultural laborers; and (3) the determination of fair and reasonable prices to be paid for sugar beets and sugarcane by processors who are also producers and accordingly apply for payments under the act. Our experience so far has been insufficient to warrant final recommendations on these problems, or to warrant any suggestions as to revision of the general policy of the Sugar Act. Meanwhile, information is being obtained through public hearings and investigations as to conditions in the various sugar-producing

areas. This should be of material assistance to the Congress and to the Administration in perfecting our national sugar policy.

ADMINISTRATION OF COMMODITY EXCHANGES

The general farm program, including crop loans, crop insurance, and parity price-adjustment payments, is of such magnitude and importance as to overshadow the activities of the Department that relate to markets and marketing. This was inevitable. We must not lose sight, however, of the necessity for keeping trade channels open and seeing that the machinery of distribution is functioning smoothly and efficiently.

There is apprehension in the grain and cotton trades that the no-recourse feature of the crop loans may result in a minimum-price program and become the indirect means for outright price fixing. Excessively large supplies and severe price declines, in the case of some commodities, have caused crop loans to operate as minimum-price guaranties. While this has been of great temporary benefit to producers, it would be unfortunate and would defeat the purpose of the crop-loan idea if price fixing were to become the major objective.

Price fixing cannot solve problems that are rooted in an unbalanced adjustment between production and effective demand, and cannot succeed as a permanent policy. The use of commodity loans to avoid dumping on temporarily glutted markets has a stabilizing effect on prices. But the impoundment and storage over long periods of unusually excessive supplies of which there is more than a temporary surplus tends to emphasize their weight on the general price level and when carried beyond a certain point may contradict the principle of the ever-normal granary. When surpluses accumulate it is important to emphasize movement and marketing. This is accomplished best when the agencies of distribution are well established and, through world-wide contacts, are competitively alert to discover every possible source of demand.

To gain and hold our proper share of the world's trade in agricultural products we must preserve the initiative as well as the facilities of an efficient and extensive marketing system. The commodity exchanges are the nerve centers, so to speak, of the present system. They must be kept free of artificial and manipulative influences. Speculation must be kept within bounds, and questionable trade practices must be eliminated. The Commodity Exchange Administration has made substantial progress in aid of these purposes. Future trading in grains, cotton, butter, eggs, millfeeds, potatoes, and wool tops is now under its supervision, wool tops having been added by special amendment on April 7, 1938.

Changed Attitude of the Exchanges

Farmers have criticized the commodity exchanges for many years. Some of this criticism the exchanges have brought on themselves by

an apparent disregard of the public interest, and a blind determination to avoid examination by public agencies. The more important commodities dealt in on organized exchanges have been brought under the Commodity Exchange Act, and future trading in these commodities is now under scrutiny by the Federal Government. As a result there is a marked tendency, even among the former critics of the exchanges, to reexamine them and their methods, to reexamine trading in futures, and to reach a new estimate of the value of the entire system. Officials and members of the exchanges have changed their attitude materially with regard to Federal regulation. They have cooperated in the elimination of abuses and in study projects to improve the futures markets.

Cooperative associations of producers, if they meet qualifications set forth in the Commodity Exchange Act, are entitled as a matter of law to representation on contract markets. They have had this right under the Grain Futures Act since 1922. The exchanges, however, have found it difficult to reconcile their members to the type of competition introduced by the cooperatives. Recently they have become more liberal as regards the admission of cooperative associations to membership and less insistent on technical points. This is noteworthy as indicating a more enlightened and public-minded view than the exchanges held a few years ago.

Constitutionality of Amendments Upheld

Three cases involving the constitutionality of the 1936 amendments to the Commodity Exchange Act were decided by the United States Supreme Court in favor of the Government. The act therefore appears to be established on sound constitutional ground. The basic law, formerly known by the short title, Grain Futures Act, had been broadly upheld in earlier cases.

The year 1937–38 saw sharp declines in the prices of major farm commodities. Wheat futures prices dropped nearly 50 percent in a fairly continuous decline throughout the year. Corn-futures prices descended even more. Drastic price declines occurred also in cotton and other commodities. In past years when such severe declines have occurred in the futures markets they often have been associated with or have followed periods of increased and even excessive speculative activity. This was not the case in 1937–38. The volume of trading in futures suffered a severe reduction in almost all cases. There was no evidence that short selling by speculators was a factor in the decline.

WEATHER REPORTS AND INVESTIGATIONS

Weather conditions have been decidedly more favorable for agriculture since the recent series of severe droughts, which extended through 1936. Rainfall in most areas from the eastern Great Plains eastward has been sufficient in most places for the crops and has largely restored the subsoil moisture. There have been no wide-

spread harmful deficiencies in rainfall since 1936. In the normally drier western Plains, however, marked improvement did not come until the early part of 1938. Precipitation in that area in 1937, though much greater than in 1936, was still below normal, and droughty conditions continued in a wide belt northward from the southwestern Plains. In fact, the subsoil moisture is still far below normal in this region.

The spring of 1938 brought widespread frequent rainfall, which furnished abundant moisture for crop needs rather generally. Wet soil in much of the interior delayed planting. In fact, the spring was one of the wettest on record. All the States had above-normal rainfall, except those in a narrow belt in the extreme South from Florida to southern New Mexico, in a limited northeastern area, and in a few localities in the far West. In Florida, however, a severe spring drought developed, which damaged truck and citrus fruit. Abundant moisture in May improved the citrus groves rapidly. Spring frosts damaged wheat in the southwestern Winter Wheat Belt, and fruit in the Central and Eastern States.

In the main, weather conditions during the spring and early summer were generally favorable for crops, and especially favorable for grass and hay. There was dryness in the Dakotas in June, where subsoil moisture was still scanty. This was rather unfavorable for spring wheat. Cool weather in June retarded the germination of corn. Widespread showers in the Corn Belt about the middle of July, however, were timely and helpful, and heavy rainfall in the Eastern States in July corrected moisture deficiencies that had accumulated there. Indeed, the heavy July rains did considerable damage to crops, to small bridges, and to roads in eastern and southern areas from New England to Texas. About 80 percent of the United States had above-normal precipitation in the first half of 1938. The average for the country was 15.73 inches or 12 percent above normal.

More Rainfall Indicated

The improved moisture conditions suggest that the recent long drought period has about spent itself and that immediate future years will likely have more abundant rainfall. But weather history repeats itself. The successions from dry to relatively wet periods and vice versa are irregular and not yet predictable, but following previous long droughts we have had periods of abundant rainfall. Should the same thing happen again, false optimism should be avoided, for there is no basis for the belief that favorable weather will continue indefinitely. The long-time records show that in relatively dry areas such a condition is abnormal and transient, and future years doubtless will bring droughts just as severe as those of the period 1930 to 1936. Extended drought occurred similarly from 1886 up to about the middle of the 1890's. Then came a series of years with comparatively abundant rainfall and farmers wrongly inferred that the favorable conditions were normal. In long-time agricultural planning for normally drier areas, such as the western

portion of the Great Plains, it is imperative to develop an agriculture adapted to the drier epochs rather than mainly to the wetter intervals.

In long-range agricultural planning it is desirable if not imperative to have reasonably reliable long-range weather forecasts. Meteorologists have investigated the possibility of long-range weather forecasting for many years. As yet they have not discovered the secret. In 1936, with special research funds available under the Bankhead-Jones Act, this Department began an investigation of the problem. The first phase was a survey of methods and results in previous investigations. Analysis of published papers and data indicated that little could be expected from the long-range forecasting methods previously advocated, with the possible exception of a method developed by Franz Baur, of the German Institute for Long-Range Weather Forecasting. In its second phase the Department's inquiry sought to develop new methods based partly on the previous experience of various long-range investigators and partly on the application of meteorological principles not previously used in this type of work. The Weather Bureau cooperated in the study with the Bureau of Agricultural Economics and the Massachusetts Institute of Technology.

The long-range forecasting work of Baur, which the investigators found to be the most promising contribution, depends partly on the daily analysis of charts of the Northern Hemisphere. Accordingly, the Department arranged for an enlarged Northern Hemisphere chart program at the Massachusetts Institute of Technology. In this project, which the Weather Bureau will supervise, the Bureau of Agricultural Economics will conduct statistical studies from an experimental 5- to 10-day forecasting program. The methods will be similar to those used by Baur. Daily analysis of weather charts for the Northern Hemisphere has been a vital part of the project from the beginning. It has been of fundamental importance in indicating the character and magnitude of weather trends and changes, and it has reached a point where it can be incorporated in actual test forecasts.

Physical meteorology is a fundamental element in the investigation. Long-range forecasting must depend ultimately on knowledge of the physical process involved in persistent weather conditions and fluctuations. Statistical data covering periodicities and correlations will continue to be necessary. In addition, the meteorologists are seeking light on the underlying causes, for example, of such changes in the atmospheric circulation as led to the Ohio River floods of 1937 or to the drought years in the Middle West.

Studies of Hot and Cold Waves

Investigations during the last fiscal year produced valuable data with regard to hot and cold waves. Winter weather over the United States is largely dominated by the cold high-pressure areas of Canada which accompany cold-air outbreaks. In summer, on the other

hand, high-pressure areas at upper levels over warm regions in the southern and central parts of the country control the circulation. Cold high-pressure centers form at the surface from radiational cooling during the more or less sunless northern winters. Meteorologists studied the release of the cold waves, and found the mechanism closely related to the circulations around the apparently dynamically created, upper-level, warm, high-pressure centers. Warm currents overlap the cold northern air masses and form an inflow aloft, which compensates for the downward contraction of the air in the lower, cooled portion. These findings influenced the investigators to study the cold highs and the warm highs together instead of separately. They brought the air circulation between northerly and southerly latitudes into one investigation.

The object is to trace the circulation pattern. This can be done by following the course of what the meteorologists term "injections" or "tongues" of high water-vapor content in well-defined paths through the atmosphere. Airplane and balloon soundings indicate the paths of moisture and the nature of the circulations at the upper levels. Studies in the recent drought areas showed that deficient precipitation is associated with absence of the usual moisture tongues of water vapor. This is the result of a peculiar change in the normal high-level circulation.

In studies of the cold air of Canada and Alaska, the investigators needed more upper-air data. They conducted upper-air soundings at Fairbanks, Alaska, during the winter months. Self-recording radio-transmitting instruments attached to balloons penetrated the atmosphere to great heights. The resulting observations, combined with data obtained by the Canadian Government in airplane ascents, furnished an important contribution to the meteorological studies. Another type of investigation dealt with solar variations as they may affect the atmospheric circulation. Meteorologists studied atmospheric ozone as a possible link between solar activity and changes in our atmosphere. Solar variation at wavelengths mostly in the ultraviolet region of the spectrum may be connected with atmospheric changes with the ozone acting as a connecting link. Observations in Europe have indicated rather striking correlations between the ozone content of the atmosphere and the weather.

Ocean Weather Investigations

Marine climatology may help agriculture. Many investigators have sought to determine the relation between the weather over the oceans and the weather over the land. There is no doubt that a significant relationship exists, but the nature of it cannot be established until we know definitely the history of weather fluctuations over adjacent and possibly over distant ocean areas as well as over the continents. Weather histories over long periods are available for the continental United States. Parallel histories are not available for the weather over the oceans. The distribution of marine data is very irregular and in many large areas the observations are scanty. Even

in selected areas of heavy shipping, the series of dependable values is short. With the help of the Weather Bureau, the Works Progress Administration at New Orleans, La., is making compilations of ocean weather data. About 5½ million observations from ships covering mainly the period between 1885 and 1933 have been summarized and transferred to world charts for publication in an atlas. This will help to indicate the normal conditions of wind, cloudiness, rainfall, fog, mist, haze, thunderstorms, and wet-bulb depression by months or seasons for the navigable oceans of the world. In addition, for the North Pacific and North Atlantic Oceans it will give the temperatures by months. Additional compilations and charts will show air and water temperatures for selected ocean areas. Special studies of ocean areas near the United States, for periods that were abnormally wet or dry in the southern Plains States, may throw light on the problem of recurrent drought periods. The data may help in long-range weather forecasting.

Flood Service Expanded

The Weather Bureau has reorganized and expanded its river and flood service. In this work it has moved along three principal lines: (1) Refinement of the observation and reporting system of effective rainfall in upstream basins of major drainage areas; (2) the analysis of rainfall and storm data for use by the Army in the design of flood-control works; and (3) expansion of the mountain-snowfall service in the West.

In the headwater forecasting service on tributary and headwater streams the changes have been confined mainly to the Northeastern States. They have been concentrated specially on the Allegheny, Monongahela, Delaware, Schuylkill, Susquehanna, Merrimack, and Potomac Basins. About 160 recording rain gages have been established, many of them by cooperative arrangement with the United States Geological Survey and the Commonwealth of Pennsylvania. Several new river-stage reporting stations have been established, and the reporting system improved. As a result, river forecasters can obtain information on the quantities and the discharge of river flow from 6 to 24 hours earlier.

Collection and tabulation of evaporation data progressed rapidly as a W. P. A. project. The Weather Bureau conducted a storm study in cooperation with the Corps of Engineers of the Army. The object was to determine the maximum flood-producing characteristics of regions in which the Army engineers have flood-control works in prospect. These studies should yield information of permanent value in land treatment for flood control or soil conservation as well as in downstream engineering. As part of its mountain-snowfall service the Weather Bureau has established 20 new mountain-snowfall stations and 20 more will be established in the fiscal year 1939. This service will ultimately provide snowfall run-off data for general river and flood forecasting on all significant drainage basins of the West.

NEW GOALS IN AGRICULTURAL RESEARCH

Systematic agricultural research dates back only about half a century in the United States; it has grown tremendously particularly during the last two decades. Recently it has changed considerably both in its organizational pattern and in its objectives, and even the scientist, not to speak of the layman, seldom fully realizes the new implications. The new trends are a response to changing national conditions, which require the better coordination as well as the redirection and expansion of research activities.

Farmers and nonfarmers have long recognized the value of agricultural research as a means of technological progress in agriculture. Both groups are coming now to see that agricultural research can help solve economic and social as well as technical problems; that it can improve rural life as well as rural production. This is a happy development. In the United States agricultural research depends almost entirely on public funds, and public opinion ultimately controls its character and volume. Federal and State projects in agricultural research reflect the demands of the public as expressed in legislation. Necessary changes and developments can come about only through the influence of informed public opinion.

In large measure this Department and the State experiment stations have directed their research toward the solution of problems uppermost in the minds of farmers. They have responded directly to the pressure of agricultural wants. Formerly the problems uppermost in farmers' minds were largely technical. They concerned the control of agricultural diseases and pests, the efficient tillage of the soil, the development of superior strains of crops and types of farm animals and the organization of the individual farm business.

In recent years the farmers have become very conscious of their economic and social problems. They have felt a need for crop and market news, for guidance in planning their production both individually and collectively, for national policies calculated to improve their market at home and abroad, for help in conserving the soil, and for help in dealing with problems of credit and of land tenure. Accordingly, research programs of the Federal and State agencies have come to include the study of these and kindred problems. What has been done shows that problems of this kind fully admit of scientific study, and also that related problems outside the agricultural field such as those of transportation, of tariffs, of industrial production and employment, and of international relations have profound significance for agriculture.

Developments in Economic Research

Research in agricultural economics in the United States goes back to the turn of the century, when the State experiment stations of Minnesota, Washington, and New York began farm-management studies. Shortly afterward this Department undertook similar investigations; in 1905 it created the Office of Farm Management.

There had previously been a Bureau of Statistics in the Department that had collected crop information; but it had not done any large-scale work in the study of economic problems. In 1921 the Department merged the Office of Farm Management, the Bureau of Markets, and the Office of Crop Estimates in the Bureau of Agricultural Economics and began a great expansion of its research and service in agricultural economics. Meantime, the State experiment stations undertook more research in the social sciences.

This movement received a further impetus from the Purnell Act of 1925, which authorized the use of Federal funds by the State experiment stations for research in agricultural economics and rural sociology as well as in other fields. Research in home economics assumed an important place under the Purnell Act; likewise research in agricultural cooperation and other investigations of group activity. Federal-State cooperation in research under the Purnell Act embraced numerous fields in agricultural economics and rural sociology. Agricultural research in the economic and social sciences had come to be on an equality with agricultural research in the biological and physical sciences.

Another step became possible—the synthesis of integrated research in these different fields. Coordinated research often produces results very different in character from the mere summation of separate findings. As an example we may notice certain investigations now going forward with regard to insecticides. Fruit and vegetable growers long ago asked scientists to protect their crops against insects and the scientists gave them sprays. Next the farmers asked for something to make the sprays stick. They got adhesives. The next problem was to get the insecticides unstuck. This was the spray-residue problem. It became a joint problem for the biologist, the chemist, the economist, and the physician with the object of discovering insecticides with power to kill insects and not harm humans.

Applying Research to Action Programs

In the application of research to the great action programs we can trace two main developments:

(1) Agricultural science gradually ceases to be mainly analytical, and to consist largely in the segregation of problems into minute parts for separate specialized study. Synthesis becomes more and more necessary; in other words, a cross-fertilization of chemistry, biology, and economics. Action programs on a national scale require the combination of many different specialties in correct proportions. In the economic field, for example, outlook reporting based on crop and market news led through well-known stages to the method of collective or concerted farm adjustments involving practically all the agricultural sciences from soil chemistry to farm management. Necessary preliminary research brought chemists, agronomists, agricultural engineers, entomologists, economists, and social scientists into an effective collaboration.

(2) Agricultural science increasingly presupposes a collective rather than an individualistic application of the results. It gathers information often different in character from that which it assembled previously for the individual use of the farmers. Soil and crop studies, for example, explore economic and social implications on the assumption that land use programs will be developed for whole regions, with the organizing power of public agencies behind them to enlist the cooperation of all land occupiers. Prospective action through public agencies gives life notably to research in the possibilities of flood control. Research of this type establishes new patterns in research coordination and requires an exceptionally high degree of teamwork among specialists.

Also, it calls for flexibility in the administration and use of research funds. Congress accorded greater flexibility and wider latitude to the Department in the administration of research funds under the Bankhead-Jones Act, approved June 29, 1935. This measure recognized an increased necessity for fundamental research, and partly met that need. It provided also for additional basic research in the State agricultural experiment stations, and for the establishment of research laboratories in major agricultural regions. It authorized and directed the Secretary of Agriculture to conduct scientific, technical, and other research into laws and principles underlying the basic principles of agriculture in its broadest aspects, and provided funds for the purpose in addition to research funds otherwise available.

Better Coordination Necessary

With these new facilities it became the duty of research administrators and research workers to attain higher standards in the effective coordination of their activities. Teamwork became more necessary as a supplement to individual effort. There was an urgent call for coordinated findings directed toward national objectives, and for a closer tie-up between research and action. There was special need for cooperation between the natural and the social sciences. The collective application of agricultural research, which received its first major impetus under the Purnell Act, came increasingly to supplant the extreme individualism which had been the guiding principle of research in the nineteenth century.

Needless to say, coordination among research workers is not new. Cooperative research goes back a long time in the Federal and State agencies. In the 1890's for example, the Association of Land-Grant Colleges and Universities facilitated a cooperative study of the adaptation of peach varieties in different sections of the country. Experiment stations in the Southern States worked together in developing a method for immunizing cattle against fever. The national soil survey has been a cooperative undertaking between the Federal Government and the States from its inception in 1899. More than 1,350 formal agreements cover research projects in which bureaus of this Department cooperate with State experiment stations. Many

informal arrangements develop a higher degree of coordinated and cooperative research.

In recent years, however, the coordination of research has made great progress and embraced studies not coordinated formerly. Some cooperative projects bring together simultaneously the work of several bureaus of this Department and of several of the State experiment stations. Examples are various studies of input and output in milk production, in which economists and dairy husbandmen cooperate; also studies of farm adjustment by regions and type-of-farming areas. These farm-adjustment studies involve the coordinated activity of practically the entire staffs of the 48 State experiment stations, as well as of this Department's Bureau of Agricultural Economics and its Agricultural Adjustment Administration. Certain weather studies involve the work of six Department bureaus, five State experiment stations, and one land-grant college.

Regional Research Projects

Cooperative and coordinated research gained an important impulse from the establishment under the Bankhead-Jones Act of regional research laboratories. This Department has authority to determine the location of the laboratories, their programs, and their budgets. It has asked the State experiment stations to submit projects and plans. So far, eight regional laboratories have been established, on the basis of recommendations worked out in consultations with State agencies. Representatives of the Department and of the State experiment stations collaborated with the directors of the regional laboratories in formulating the research programs. On the staff of each regional laboratory and its advisory group are representatives of the different scientific fields involved.

Approach to National Problems

Research on national agricultural problems acquired a new direction and a new purpose with the creation of the Agricultural Adjustment Administration, the Soil Conservation Service, the Farm Security Administration, and other action agencies. Studies of production and consumption, of the economic basis and social aspects of crop adjustment, of the use and conservation of soil and water, and of other matters of general national concern took on new life when the object was to incorporate the results immediately in action programs. Findings had to meet the tests of practice quickly. Soil studies with erosion control in view, for example, had to consider the economic, legal, and social problems involved, as well as the biological and physical problems of agronomy and engineering. The result was increased realism in the final recommendations and procedures. The action programs required a synthesis of many techniques rather than the ideal application of one or two.

Programs made possible by the Omnibus Flood Control Act of 1936, the Bankhead-Jones Farm Tenant Act, the Norris-Doxey Act

of 1937, the Pope-Jones Act of 1937, and various acts affecting forestry, wildlife, drainage, and other matters of national moment absolutely necessitate concerted action among research workers and administrators. Research workers have to assume responsibility for putting their ideas and knowledge into practice. They have a new and broader opportunity. Without ceasing to be specialists they must take broad views and see the whole as well as the part. On the other hand, effective coordinated research depends greatly on the administration of it. The interpenetration of the different sciences, with the resulting necessity for the specialist to become something of a generalist, affects administration as well as research. It is impossible any longer to draw a sharp line between research and administration, and to let research workers hand their findings over for practical application to another group unfamiliar with research. Administrators must also be scientists if they are to visualize problems in their correct aspects and to organize research and service for the best net results.

"NEW-USE" RESEARCH EXPANDED

Chemistry has been associated with nearly every line of agricultural progress and it has greatly increased the efficiency of agriculture in recent years. Knowledge of the chemical composition and properties of soils has been useful in classifying soils and in determining what types are best fitted for cultivated crops, grass, or woodland. Knowledge of soil fertility and plant nutrition, obtained by chemical investigations, has led to improved farm management, more efficient use of fertilizers, and other soil amendments. Investigations in industrial chemistry have resulted in an abundant supply of fertilizer materials and improved mixed fertilizers. Chemical studies have helped to determine the erodibility of soils and indicated means for reducing soil erosion. In a cooperative program designed to prevent soil erosion through the growth of soil-holding plants, the selection of plants may be partly guided by chemical science.

Information about the chemical factors needed in the diet of farm animals and about the composition and nutritive value of various feedstuffs has led to more efficient production of meats, milk, and eggs. Chemical investigations have thrown light on the causes of certain plant and animal diseases and indicated means for their prevention or control. Chemical research has resulted in new and improved insecticides, fungicides, disinfectants, and poisons to aid the farmer in fighting agricultural pests. Chemical methods of eradicating noxious weeds have been developed. Preventing the deterioration of some products, especially during storage, is made possible by a knowledge of the chemistry involved.

The profitable utilization of agricultural products depends largely on knowledge gained through chemistry and related sciences. The chemical composition of agricultural products determines their utility. Food for men and domestic animals is the largest and most

profitable outlet for agricultural products, and the use of natural textile fibers for clothing and other fabrics is the second largest. But other outlets are made possible by chemical processing. The conversion of agricultural products into manufactured nonfood products almost invariably involves chemistry. This Department has long been interested in developing such outlets through chemical and technological research, and also in introducing and producing in this country crops for which there is industrial demand.

Utilization of Crop Wastes

Chemists in the Department gave early attention to the composition of cornstalks and corncobs and the uses for which these crop wastes might be suitable. Experiments in cooperation with industry helped to determine the paper-making value of cornstalks, sugarcane bagasse, and other crop wastes. Experiments in the production of paper pulp from native trees aided the development of pulp industries in the South and in the Pacific Northwest which utilize native pines and hemlock. The Department has studied native trees and plants as possible sources of vegetable tanning materials for use in the leather industry, and has introduced tannin-bearing species of chestnut which are resistant to the blight that is destroying our native chestnut trees. It has demonstrated that the waste bark from western hemlock trees can be used profitably as a source of valuable tanning extract.

The commercial production of fast and brilliant dyes has brought about an increased utilization of cotton in clothing and household fabrics. New technical methods for making phthalic anhydride and other dye intermediates, developed through chemical research in this Department, were an important factor. Treatments developed in the Department for waterproofing, mildewproofing, fireproofing, and retarding the deteriorating effect of sunlight, have increased the utility of cotton fabrics for outdoor use.

α cellulose, obtained by refining cotton linters and certain kinds of wood pulp, is used in chemical industries for the manufacture of rayon, transparent wrapping material, and cellulose compounds for explosives, lacquers, and plastics. This material can be separated from sugarcane bagasse and possibly from cornstalks by a process developed in the Department and now ready for industrial application. Nitric acid, which is required for this process, at one time was too expensive to use. It has been greatly reduced in price as the result of chemical fixation of atmospheric nitrogen.

The hemicelluloses (pentosans and hexosans) in crop wastes have been the subject of chemical investigations to discover possible uses for them. Xylose (wood sugar), furfural, and an adhesive gum can be made from the hemicelluloses in corncobs. Furfural, formerly a rare and expensive chemical, was made in substantial quantity by the Department and supplied to firms and individuals who cooperated in finding industrial uses for it. As a result, furfural is now being produced commercially at a low price from oat hulls. Should

the quantity of oat hulls available be inadequate, corncobs, cottonseed hulls, rice hulls, and other crop wastes can be used. No industrial use for xylose has yet been found.

Economic Problems Involved

The Department has also investigated lignin, one of the major constituents of wood and crop wastes, to find means for its industrial utilization. Several possible chemical uses have been found, some of which may have an industrial application. The lignin in the waste liquor from sulphite pulp mills is being used industrially for the production of vanillin, a flavoring material. Research in the Department has shown that this waste may also be ammoniated and used as a fertilizer, and that it has value in the treatment of industrial water supplies for the removal of iron and manganese. Waste liquor from sulphite pulp mills is being used abroad for the production of motor-fuel alcohol.

The Department has conducted research on the production of alcohol from various farm products, including cereals, potatoes, and sweetpotatoes. At present the principal raw material used for the manufacture of industrial alcohol is blackstrap molasses, an inedible byproduct of sugar refining. Agricultural products would have to sell for extremely low prices to compete with blackstrap molasses. As a rule, edible agricultural products are more valuable for food purposes than for the manufacture of industrial alcohol. The large-scale production of alcohol from agricultural materials cheaply enough to compete with gasoline for use as motor fuel may have to wait until the price of gasoline increases materially as the result of diminished supplies of petroleum.

Research has also been conducted by the Department on the manufacture of ethyl or so-called grain alcohol from wood by first hydrolyzing the cellulose to sugar and then fermenting the sugar. Commercial production of ethyl alcohol from wood was started in this country but was discontinued because of difficulties arising from the complex character of the intermediate product.

Naval Stores Research

Pine gum is one of the few agricultural products used exclusively for nonfood purposes. Turpentine and rosin, chemical products derived from the gum of southern pines, rank high among our chemical exports. Rosin has many industrial uses, but it is used principally in the manufacture of paper size, soaps, and varnishes. At one time the quality of varnishes containing rosin was very inferior, but chemical research showed that very high-grade varnishes can be made by chemically combining rosin with glycerin and cooking this product with tung oil. Turpentine finds use in industrial products, such as paints, varnishes, and shoe polishes, because of its value as a volatile thinner and solvent. It is also of value in the manufacture

of some chemical materials, principally synthetic camphor, which is extensively used in celluloid and similar plastics.

Chemical and technological research work in the Department has contributed much to the naval stores industry by developing improved practices and equipment for handling gum and its products, as well as by devising more efficient stills and controlled distillation processes. Also, by studying the chemical composition of oleoresins, turpentines, and rosin, and by showing the possibilities of producing new products, which may have special industrial uses, the Department has helped solve problems connected with the utilization of turpentine and rosin.

Current Lines of Chemical Research

Linseed oil and other vegetable drying oils are derived from crops grown exclusively for industrial chemical uses. Flaxseed for linseed-oil production is grown to a very limited extent in the United States. There is need for much larger domestic sources of drying oils. The Department assisted in the introduction of tung nut production, a rapidly growing branch of agriculture, into the Southern States, and it is now investigating the possibilities of growing perilla seed and other sources of drying oils in this country.

Commercial production of sweetpotato starch for industrial uses has resulted from research in the Department on methods for obtaining a high-grade white starch from sweetpotatoes and on the utility of the starch for various purposes. The problem of storing sweetpotatoes to permit continuous operation of a starch plant is nearing solution.

Research in the Department on the production of organic acids by mold fermentation of glucose (corn sugar) has revealed organisms which give good yields of gluconic, citric, kojic, and dextro-lactic acids. Gluconic and citric acids are being produced commercially by mold-fermentation processes. The calcium salt of the first is used medicinally in the treatment of animal diseases due to calcium deficiency. The second is used extensively in beverages, medicines, and food products. Industrial uses for kojic and dextro-lactic acids have not yet been found.

The Department has developed a new method, together with the necessary equipment, for conducting mold fermentation in submerged condition and under increased air pressure. This method, which is more rapid and efficient than surface fermentation, may be used in any oxidative fermentation process.

Work at Byproducts Laboratories

Some years ago the Department established an agricultural byproducts laboratory at Ames, Iowa, in cooperation with Iowa State College. Researches are being conducted there on the utilization of crop wastes, such as cornstalks, corncobs, and straw, for the production of useful products by chemical, fermentation, and destruc-

tive-distillation processes. More recently the Department, in cooperation with the 12 North Central States, established a regional industrial soybean products laboratory at Urbana, Ill. The object of the chemical researches at this laboratory is to determine how the composition of soybeans is affected by variety, soil, and climatic conditions, to improve soybean products for particular uses, and to develop new industrial uses for soybeans.

Encouraging progress has been made in both these regional laboratories. In addition to these, a laboratory at Olustee, Fla., is devoted to chemical and technological research on the production and utilization of turpentine and rosin; 1 at Madison, Wis., is working on the utilization of timber and other forest products; 1 at Auburn, Ala., is investigating the uses of sweetpotato starch; and 10 in California, Florida, Oregon, Washington, Texas, New York, North Carolina, and Hawaii are investigating various problems connected with the utilization of agricultural products, especially fruits and vegetables, for food purposes. Several field laboratories are also maintained for studies relating to the production of cane and beet sugars.

Additional Laboratories To Be Established

In 1938 the Congress authorized and provided funds for the establishment of four additional regional laboratories to conduct research on the industrial utilization of surplus agricultural products on a much larger scale than had been possible heretofore. It provided $4,000,000 for the establishment, maintenance, equipment, and operation of the laboratories, and $4,000,000 annually for the designated research. A survey, also provided for by the Congress, is now being made to determine the extent to which agricultural products are being used by industries, the possibility of expanding present uses, and the nature of the related investigations conducted by State agricultural experiment stations, educational institutions, privately endowed research laboratories, and industrial research laboratories. This survey will help in determining the best location for the regional laboratories and in formulating the research programs.

Agriculture has benefited greatly already from chemical research regarding the industrial utilization of agricultural products, and it should benefit further from increased similar activity. But the research program should not be expected to produce substantial results in the near future, nor to solve completely the problem of profitably utilizing all the material that can be produced on American farms above the quantities required for food, feed, and textiles. Chemical research can show how to convert agricultural raw materials into useful products through chemical processing, but it cannot provide adequate markets for all farm products and byproducts.

Implications for Agriculture

In the manufacture of industrial products from agricultural raw materials, different materials are often interchangeable. The sub-

stitution of one agricultural material for another, because of changes in their relative abundance, in their prices, or in other conditions, may benefit the manufacturer and certain branches of agriculture, but not agriculture in general. Agriculture benefits only when agricultural raw materials are used instead of nonagricultural raw materials. Agricultural products must compete with materials from mineral sources as the raw materials for many industrial products. Petroleum, coal, and natural gas are the present sources of important chemical products, including liquid fuels, which probably can be made also from agricultural products. As long as they are abundant and cheap, they will continue to be used in preference to agricultural raw materials.

Thus, the problem of the industrial utilization of agricultural materials is not simply one of chemistry and technology, but also one of economics. Expanding the uses of industrial products for which agricultural materials are particularly well adapted and chemical processing of agricultural raw materials into new and useful industrial products which cannot be produced as readily from mineral substances offer the greatest hope for the increased industrial utilization of farm products. As our present resources of petroleum and coal approach exhaustion, the products of the land must of necessity be used as sources of gaseous, liquid, and solid fuels. It is not too soon to begin the study of means by which these changes may be accomplished.

AGRICULTURAL ENGINEERING HAS WIDE SCOPE

The effectiveness of the agricultural engineer depends not only upon his understanding of farm problems in such fields as drainage, irrigation, structures, and mechanical equipment, but also upon an appreciation of the parts played by weather, soil, crops, livestock, processing, and marketing. As agriculture develops in a pattern of more studied design, engineering knowledge can be brought to bear with increased effectiveness. By reducing hazards of too much or too little water, uncertain fertilizer benefit, changeable weather, and haphazard storage and handling, the output of usable products becomes more accurately predictable.

In working toward these ends, the Bureau of Agricultural Engineering investigates various means, such as control of the water table in soils through drainage; prediction of the probable irrigation-water supply through snow surveys; development of better storages for such major crops as corn, wheat, and potatoes; improvement in fertilizer placement; redesigning of planting machines; perfecting of harvesting methods and machines to cut costs; widening the use and preserving the value of crops harvested under adverse weather and labor conditions; study of farm-operation factors as a whole to make the farmers' production unit as efficient as possible. Agricultural engineering has a close relationship with the biological, economic, meteorological, and other factors in agriculture.

The control of ground water at optimum levels is one of the first essentials to profitable agriculture. Many farms are too poorly drained to assure adequate protection against damaging overflows, backwater hazards, rising ground water, or disastrous alkali accumulations. The security of loans extended to drainage districts formed by groups of farm owners and to individual farmers depends on adequate maintenance of drainage works; and proper control of water in the soil must be maintained.

Land-drainage maintenance is now emerging from a long period of depression. The Federal Government has assigned 39 Civilian Conservation Corps camps to the Bureau of Agricultural Engineering to assist in maintaining public drainage systems. In May 1938 these camps were permanently established as a part of the future Civilian Conservation Corps program. Organized improvement districts, local communities, and Federal agencies are cooperating.

The Department engineers have developed a technique covering the engineering phases of drainage work in large-scale community drainage projects, on individual farms, and in irrigated areas. Intensive research into cement qualities and concrete mixing and curing methods is providing ways of making concrete drain tile resistant to soil alkalies and acids. Here the agricultural engineers faced a problem involving the chemistry of soils, cement, and concrete. Testing procedures recently developed in this work have been used in selecting cements for important governmental water-control structures. Irrigation in the humid States is receiving widespread attention and is helping to stabilize crop yields. Incidentally, the growth and fruiting habits of crops have had to have consideration along with the means of economically supplying water.

Advance in Irrigation Practice

An outstanding advance in irrigation practice is resulting from the development of an improved method of laying out furrows for water distribution. In California orchards it has been demonstrated that broad, shallow furrows may be used successfully.

The problem was not merely to get water to the trees, but to modify the chemical content of the soil and conserve the soil itself. As ordinarily marked out in loose soil, the steep sides of the narrow, deep V furrows permit a maximum of erosion. Water must be advanced along the furrow very slowly, and an excess of water penetrates near the upper ends of the rows before the lower ends can be irrigated. The broad, shallow furrow was developed to overcome these and other difficulties, and the Department's engineers devised a machine to make furrows with a smooth bottom 20 to 24 inches wide.

As a result now of this purely mechanical contrivance, based on an understanding of a variety of needs, penetration in the broad furrows is more nearly like that from rainfall, there is better control of plant nutrients and, when necessary, leaching can be provided to control injurious salts. Furrows of this type are likely to come into

general use in orchard irrigation and for control of run-off resulting from heavy rainfall.

Several years ago the Department began making irrigation water-supply forecasts based on snow-cover surveys in 11 Western States. Here, again, was a combination job involving not only engineering but also the results of work by weather men and foresters and having results of value to municipalities, financial concerns, and power plants as well as to agriculture. Cooperation by individuals, industrial concerns, and local governments has grown beyond expectations. The forecasts are being made with sufficient accuracy to justify the effort. Where the work has been in progress for 5 or more years (including periods when State or local organizations carried on observations before this Department entered on the project), the forecasts have been approximately accurate.

Farm Storage Findings

One important requirement of the ever-normal-granary program is that grain be stored with little loss in quantity or quality. The Department must specify the conditions under which grain reserves shall be stored to be eligible for Government loans. Hence, it is making a careful study of farm storage of wheat. As usual, the problem is a multiple one, involving not only the basic engineering of structures, but control of moisture, temperature, and pests to maintain the quality of grain. In this study the Bureaus of Agricultural Engineering, Agricultural Economics, and Plant Industry are cooperating with the State experiment stations of Illinois, Kansas, Maryland, North Dakota, and Ohio.

The study has brought out some important facts. Under typical storage temperatures low-moisture content is the most essential requirement. Deterioration of wheat may be retarded by any means that lowers the moisture content or the temperature. Ventilation, shading, and storage underground retard deterioration, but have limited usefulness. Insulated walls are of limited value in retarding the deterioration during warm weather. Insulation of walls and floors may be desirable, however, to retard concentration of moisture in cold parts of bins. Where atmospheric humidity is relatively low, the better types of ventilation remove moisture at satisfactory rates. However, in such areas harvesting conditions are usually favorable and dependence can be placed on harvesting grain when it is dry rather than on ventilating equipment. In humid areas artificial drying is probably more practical than ventilation.

Improvement of Buildings and Machinery

As acreage is shifted to grass, livestock will increase in the new pasture areas. More buildings will be necessary for shelter and feed storage. Storage of corn and wheat on the farm creates demand for more and better storage buildings. Anticipating these requirements, the Bureau of Agricultural Engineering began cooperating

several years ago with other bureaus and with State agricultural colleges in the development of better farm buildings. Improved plans are being made available to farmers, local builders, and carpenters through county agents, through dealers in materials, and through farmers' bulletins and film strips. This might be looked on as a purely engineering service but, even more than in most of the other examples cited, it represents an appreciation of other factors—climatic variations, kinds of livestock in different regions, materials available at a suitable price, the peculiarities of crops produced, processing done on the farm, legal restrictions, and health requirements.

Tillage, Pest Control, and Harvesting

Development of machinery specially adapted for use on small and family-size farms continues, notably in small power units and harvester-threshers. Recently a 40-inch combine has appeared. There are now some makes of all-purpose, one-plow tractors in the $500 class. The appearance of two-way plows and middlebusters, directly connected to tractors, indicates that equipment is gradually being worked out for use on farms where soil conservation practices are necessary. Considerable attention has been given to tractor attachments, mainly in changing the designs so they can be more readily put on and taken off and to increase their flexibility for working across terraces and on contour rows. Evidently mechanical equipment is quickly being brought into line with widespread changes in ways of farming.

Studies of fertilizer placement have brought out valuable new facts. This has been done through a consideration of the mechanics of placing fertilizer and effects of weather conditions and the needs of crops as shown by root-growth habits, seedling sensitivity, and other peculiarities. Experiments showed fertilizer was most effective as a rule when placed in a band about 2 inches to the side of the row and at a depth of about 3 inches; but the most advantageous placement varied somewhat with the kind of crop and some other factors. For sugar beets the placement of fertilizer either directly under the seed or only one-half inch to the side was most effective, while for sweetpotatoes a placement 5 inches to the side at a depth of 5 inches was advantageous. For celery in 1937, the yield from 1,000 pounds of fertilizer per acre placed in a band at each side of the row equalled the yield from 2,000 pounds applied broadcast, the common farm practice.

Studies of methods of turning under cover crops were continued in the cotton-production-machinery project in Alabama. The results indicated that the large-base moldboard plow set for good coverages produces the highest yields, though the vertical one-way 10-inch spaced disk plow may be most economical when the acreage handled per unit is considered. There is a marked demand for plowing equipment to turn under soil-improving legumes effectively in the short period between the time when they have made enough growth and the

time to plant the cash crop. Here engineers were confronted with a soil-crop problem that demanded new knowledge of machines and methods to meet conservation and soil-improvement needs.

In investigations of seedbed preparation for surface-planted corn carried on in Iowa, fall plowing to a 4-inch depth caused the best yield increase—5.8 bushels an acre—and was better than 8-inch fall plowing, blank basin listing in the fall, and chiseling 10 inches deep in the fall. Studies in machine harvesting of corn showed that field losses vary greatly with varieties and hybrids. By further cooperation with the plant breeders mechanical harvesting of this crop may be brought to a high degree of efficiency. Single-seed, hill planters for sugar beets gave promise of reducing blocking and thinning costs and of saving seed cost of $2 to $3 an acre.

Control of insects and fungi on crops presents engineers not only with the problem of killing the pests but also with the problem of doing it without leaving excessive amounts of poison residue. Repeated tests of a vapor sprayer modeled after steam cleaners used on stone or brick buildings indicate it is more effective than the conventional hydraulic sprayer in applying fungicides. It uses much less material and is about equally effective in applying insecticides.

Ginning tests of machine-picked cottons showed progress in developing pickers that will harvest a better quality of seed cotton than earlier machines. There is still much to be done to maintain the quality of high-grade cotton when mechanically harvested. Mechanical harvesters in their present stage of developments have a tendency to entangle leaf particles and other foreign material in the cotton. This material is difficult to remove at the gin.

Practical Results for Farmers

Investigations at the cotton-ginning laboratory, in which engineers and fiber specialists work hand in hand, have brought out facts of much value to farmers. With the demands of the market in mind, these investigators are trying to make it possible to meet them consistently and economically. Eleven cotton-growing States are using specially trained extension men to get the results into practice. The cotton-drying process and driers developed at the laboratory are being refined toward cheaper and better forms. Approximately 539 driers were operating during the crop year of 1937; they handled more than a million bales of damp seed cotton.

Cleaners and extractors do not damage dry cotton. By removing foreign matter, they reduce the ginning time up to 40 percent and reduce the energy consumption of gin stands up to 16 percent. Loose-roll ginning increases the value of long-staple cotton from $1.50 to $4.50 per bale and short-staple from 62 cents to 95 cents. Facts learned about the shape, condition, and fineness of gin saw teeth make possible important savings in lint and time of ginning. High power costs and complicated machinery installations make ginning charges higher to farmers. Some gins have so rearranged

and modified their equipment, on the basis of the laboratory findings, as to reduce their power costs as much as 50 cents a bale.

Lag in Engineering Improvements

The many examples just cited show highly beneficial results of agricultural engineering research conceived in the light of the various other factors of weather, soil, crops, and market demands. On the other hand, it is just as important that the various factors in good farming be adjusted as a group to the individual farm on what might be called the clinic plan. Farmers have gone far in the adoption of modern tractors and other farm machines, improved building designs, and soil improvements through drainage, irrigation, conservation practices, and other means. But the general improvement of the individual farm lags.

Studies are under way on 120 typical farms scattered over many States to determine the causes. Two outstanding conditions that retard farm efficiency are the maladjustment of enterprise and production factors and the inefficient use of available resources. Methods are being developed to inventory all resources—physical, economic, and human—to analyze the complete farm unit and to project complete operating and development plans. This involves changes required for a proper balance of labor, power, and equipment; for land improvement through drainage; for erosion control; for changing the size and shape of fields; for improving buildings for livestock and equipment and for the processing and storing of farm products.

WIDER USES DEVELOPED FOR DAIRY PRODUCTS

Nearly 40 percent of the milk produced in this country goes into the manufacture of butter and cheese, leaving large quantities of skim milk, buttermilk, and whey at the creamery or factory. In many instances it is no longer practicable to return these byproducts to the farm for livestock feeding, and the factory management must find profitable market outlets for their disposal.

The Bureau of Dairy Industry has developed information on methods of converting the various constituents of these byproducts into marketable form, for use either in other food products or in the manufacture of industrial products. One of the greatest obstacles in the way of increasing the use of products made from milk has been the cost of processing; the cost must be kept low enough, in many instances, to enable these products to compete successfully with similar products made from other materials. In recent years, however, changed conditions in the dairy industry have made skim milk and whey available for processing at many single plants, in larger volume than formerly and this fact should be an important item in lowering processing costs.

Among the skim-milk products, casein appears to have a promising future as a source of textile fiber. In the past the annual domestic

production of casein has been approximately 40 million pounds, the greater part of this being used by the coated-paper industry. The commercial production of casein fiber has developed in Italy in the past few years. Over 1,500,000 pounds of this fiber was produced in Italy in 1937, and a production of over 20,000,000 pounds is expected in 1938. The Netherlands, Poland, and England are also starting to manufacture casein fiber. So far, commercial production has not been reported in the United States. Several research laboratories in this country have experimented on methods of spinning casein into fiber. The Bureau of Dairy Industry has worked out a process for making the fiber and has applied for public-service patents.

Lactic acid and its salts are being produced from the whey resulting from the manufacture of casein at one large dairy plant in New York State. The Bureau of Dairy Industry is actively cooperating in this development, with a research program directed to increasing the uses of lactic acid and to developing new uses and new products derived from this acid. In several sections of the United States, manufacturers are anxious to produce lactic acid and await only the assurance of a market for their product before starting operations. Scientists in the Dairy Bureau have developed a resin from lactic acid which gives promise of utility as a varnish gum and as a lacquer that is resistant to alcohol and that adheres strongly to metals. A highly purified lactic acid is extensively used in making some of the synthetic plastic materials that have a wide use. Methods of producing this special grade of acid are being investigated.

In any discussion of the utilization of whey, the question of the isolation and marketing of the 4 to 5 percent of milk sugar present should be considered. Milk sugar sells at a comparatively high retail price, but the demand is quite sharply limited to pharmaceutical and nutritional uses. A process recently discovered in the Bureau of Dairy Industry may make it possible to produce milk sugar somewhat more cheaply than formerly because of the value of two other products of the process. By this process it is possible to isolate milk sugar, soluble albumin, and a residue rich in flavins separately from whey. The importance of flavins in feeds is being greatly emphasized at present and concentrated forms of these compounds are in considerable demand by feed manufacturers. Soluble milk albumin has been a goal for some time of a number of investigators who recognize the desirability of using it in infant foods. It may also be substituted for egg albumin in many instances.

Forage-Crop Utilization

Forage crops are absolutely essential for the practical and economical feeding of dairy cattle. Furthermore, dairy cows must have a good quality of forage or they will not be properly nourished. The more milk that cows produce the greater is the necessity for forage of high quality. The factors making for high quality in the

hays are universally recognized, but because of unfavorable curing weather over much of the United States it rarely happens that a farmer can make all his hay crops into hay of good quality. Weather damage to hay constitutes one of the major agricultural losses, probably 100 million dollars or more annually. Most of these losses can be avoided by making the hay crops into silage. Investigations in recent years have determined the methods by which good silages can be made with certainty from the hay crops, and this information will have an enormous influence on the farming and feeding practices on the dairy farms of the United States. Farmers have recognized the possibilities of grass and legume silage, and the practice of siloing the hay crops is sweeping the country.

In years past, failures in making silage from the grasses and legumes have not been uncommon. Often the silages were so ill smelling that the silage was not palatable. The odors were objectionable also because they were likely to taint the milk. Recent investigations have shown that these odors may be reduced or eliminated in a number of ways. Adding enough acid or acids to bring the pH value of the silage to a point below 4 prevents objectionable odors but, in the case of at least some of the acids, the palatability of the silage is seriously impaired. The addition of molasses improves the palatability, and some investigators are firmly of the opinion that molasses improves the odor, although no data on silage made in the American way have ever been presented to establish this fact definitely.

Investigations by the Bureau of Dairy Industry show that wilting the crop so that it contains not more than 70 per cent of moisture improves the palatability and the odor of the silage, and eliminates the objectionable conditions caused by leakage of juice from the silo. This is the cheapest and surest way to make good silage. Since silage made in this way develops very little acid, it is apparent that high acidity is not a prerequisite in the making of silage. Any system or type of silo which permits the air to be expelled from the siloed crop promptly, and which thereafter thoroughly excludes the air, will prevent molding or rotting. However, if the hay crop has a high content of moisture when siloed or if it becomes waterlogged with rain or seepage water, it may become malodorous.

From a nutritive standpoint, the outstanding characteristic of silage as compared with hay is the high content of carotene. Investigators still have much to learn, however, about the feeding value of silage made from the hay crops. It is certain that small or medium quantities are valuable additions to the ration. Long-time feeding trials, in which grass silage with the usual content of moisture has been the sole roughage, show that the silage maintains the milk production but not the body weight. Silage with twice the content of dry matter usually present in the green crop has been found to maintain milk production and body weight as well as hay made from the same kind of crop when each was fed as the sole roughage.

PLANT SCIENCE BUTTRESSES CROP AND SOIL PROGRAM

Plant research has been highly influential in the production of field and horticultural crops in all parts of the country. In recent years it has become more important because of its relationship to the national crop adjustment and land use programs, which draw heavily upon the accumulated results of long-continued plant research, and constantly require plant science as an indispensable guide in program planning.

Formerly, plant research looked mainly for facts about particular crops, their botanical relationships, their cultural requirements, and their uses as food, feed, or fiber. The principal object was to extend the cultivated area of each crop as widely as possible within the range of its adaptation to various conditions of soil and climate in every potential producing region. As agriculture expanded, plant research came to include work designed to combat the increasing hazards of winter-killing, drought, disease, and insect enemies, and to maintain production under certain conditions as well as to increase it under others. These problems required a close integration of specialized research, and drew together researchers in related physical and biological fields.

Industrial development and the growth of cities created food requirements that could be satisfied only through new and improved methods of food preservation and distribution. This problem became more complex with the rise of competition among producing areas. It became necessary to link plant research with economic research. Nutrition problems arose as various occupations became more sedentary, and required teamwork between specialists in plant science and specialists in nutrition. Cooperative studies investigated the composition, nutritive value, palatability, and keeping quality of numerous food crops; the nutritional values of various feed crops and their influence on the quality as well as the yield of meat and other animal products. The movement to conserve wildlife enlisted plant science in maintaining or increasing feed supplies for game.

Changes in clothing requirements necessitated research in factors influencing the physical and chemical composition of fiber. Public-health requirements, in the prevention and cure of disease, increased with the concentration of population and emphasized drug-plant culture, to which research has been regularly applied. Emergency use of accumulated plant knowledge swelled our production to meet the needs of the World War. But the war left new problems in its wake. Export markets diminished while crop surpluses piled up from acreages extended far beyond domestic needs. This situation, with complications from mounting farm debts and taxes and from acute problems of farm tenantry and serious maladjustments in land use, made demands on plant science for help in crop adjustments and also in soil conservation.

Plant Findings in Action

Among the results of long-continued plant research the Agricultural Adjustment Administration found information useful in designating soil-conserving and soil-depleting crops adapted to different regions of the United States, in regulating their use, and in defining practices necessary to comply with those regulations. The Soil Conservation Service, in grappling with problems of soil-erosion control, turned to plant research for guidance in the choice and use of erosion-resistant crops. The Farm Security Administration, the Farm Credit Administration, the Bureau of Agricultural Economics, and other agencies, utilized plant research in marginal land buying, farm-credit relief, and land-tenure reform.

Interest in the industrial utilization of farm products, byproducts, and wastes brought plant scientists into closer association with chemists and other specialists. Related studies developed new or extended uses for crops now grown or capable of being grown in the United States. Plant research guides agricultural action by making available the accumulated results of years. Conversely it responds to the needs of the action programs with new data to meet changed or changing situations. Mainly, however, it is a slow and arduous process which demands infinite patience with exacting details. The effective results are usually cumulative and not immediate; and assured dividends require continuity of effort.

Agricultural adjustment, which among other things seeks to maintain on suitable acres a high level of production, entails a choice of varieties of field and horticultural crops and methods of production. It involves also the choice of crops and cultural methods most useful in soil conservation, erosion control, pasture and range improvement, and watershed protection. Numerous experiments have provided abundant data extremely useful in this connection. Plant breeding has made available certain superior varieties which are highly resistant to cold, drought, disease, and insect injury.

Insurance against the ravages of black stem rust in the hard spring wheat region of the Central States is possible through the planting of resistant varieties. Thatcher, a variety developed by hybridization in the cooperative wheat-breeding program of the Department and the Minnesota Agricultural Experiment Station, produced satisfactory yields under severe rust conditions in 1937 and again in 1938. Less resistant varieties were near or complete failures. Important processors in England as well as the United States have pronounced the milling and baking qualities of Thatcher satisfactory.

The beet-sugar industry in Western States, which was threatened by the leafhopper, vector of the destructive curly top disease, has been revived and stabilized by curly top-resistant varieties bred by the Department. Abandoned sugar factories have resumed operations and new factories have been built. The most recent improved variety, U. S. 12, has higher curly top resistance than earlier U. S. varieties. Under extreme exposure in 1936 U. S. 12 yielded an aver-

age of 20.18 tons of beets per acre, whereas a susceptible variety yielded only 3.05 tons. More than 2,551,000 pounds of U. S. 12 seed were available for planting in 1938. Another variety, U. S. 33, slightly less resistant but a little richer in sucrose, is also available in quantity for areas in which it has proved suitable. These two varieties have reached a dominant position in the curly top area.

Multiple-Purpose Plant Research

Hardy fruits and flowers adapted to high altitudes and to the rigors of climate in the central Great Plains are welcome contributions to the livelihood of plainsmen in that region. Among the more satisfactory fruits of recent developments are several varieties of grapes, the Red Lake currant, and the Chief raspberry. Apparently no sufficiently hardy strawberry exists in the trade, but hybrids produced from crosses of commercial types with native species are promising. One of the most striking ornamental shrubs is the Mongolian bluebeard which has proved hardy and unusually attractive in the fall. Varieties of hardy chrysanthemums have been distributed to nurserymen throughout the region.

The one-variety community plan of cotton production, which both growers and manufacturers widely approve, is a constructive measure for Cotton Belt agriculture. In 1937 there were 814 one-variety communities in 343 of the 850 cotton-producing counties in 14 principal cotton States. From 2,434,367 acres these communities produced 1,863,692 bales of cotton of improved quality with $\frac{15}{16}$ to $1\frac{1}{16}$-inch staple. Premiums on this staple, averaging 50 points per pound, or $2.50 a bale, brought the growers about $4,500,000 more than they would have received from cotton not commanding a premium. Besides this, the one-variety communities realized an average acre yield increase of 40 pounds of lint, which swelled the total extra returns to growers in one-variety communities to about $13,000,000. Manufacturers are turning to the one-variety communities for even-running lots of cotton of uniform staple length and quality suited to special needs. Many southeastern mills are buying one-variety cotton from the same communities every year.

An important aid to the reestablishment of pasture and range grasses in the southern Great Plains is indicated in experimental results showing that the stubble of a preceding crop of Sudan grass or sorghum affords a desirable seedbed for grass. The Sudan grass or sorghum may be sown in close drills and harvested for hay, leaving stubble 8 to 10 inches high. A combination of drilling and broadcasting the grass seed in this stubble appears to be most effective in obtaining a uniform stand. This method gives some protection against wind erosion.

Simplified and less costly cultural methods have been developed to aid farmers in their fight against field bindweed. The killing method generally recommended calls for cultivation every 7 to 10 days, to destroy all green growth promptly, on the assumption that all leaves manufacture food materials and thereby prolong the life

of the weed. Results of recent experiments show, however, that equally effective control follows less frequent cultivation, 12 to 21 days, or when the new shoots have reached a length of 4 inches or slightly more. This reduces by half of the cost of cultivation and affords a feasible control measure that farmers will most readily be able to adopt in farm practice.

Relation of Plants to Soils

Breaking up the sod cover of the Great Plains has not decreased the quantity of water in the subsoil, according to soil-moisture records continuous on the same soils for periods up to 30 years in length. Any changes that have occurred are confined to the soil zone in which roots develop freely. Under continuous grain production this zone is usually dry at harvest time, but its water content builds up again during the fall, winter, and spring. The rate of discharge by the rapidly growing crop then exceeds the rate of recharge by precipitation, and the discharge of available water usually is complete by the time the crop is mature. Water charge and discharge are much the same under native sod as under continuous grain crops, although the sod may use water from greater depths because it contains deep-rooted perennial plants. The addition of fallow to the cropping system lengthens the period of water accumulation by a year, increases the depth of soil that functions in the production of the next crop, and increases the number of times when water reaches the subsoil.

Fire prevention is one of the most effective means of protecting a forest against infection by heart-rotting fungi. But fire protection offers little or no insurance against invasion by the western red rot, responsible for 20- to 30-percent loss in the existing merchantable stands of ponderosa pine in many sections of the country. The fungus of this rot finds its principal avenue of infection in branches over 1 inch in diameter that have died naturally.

Recent studies show that the amount of rot in future saw timber can be considerably reduced if branches are kept as small as possible until trees are at least 70 years old. Dense stocking during that period is one means of accomplishing this, but a more generally applicable method of control can be effected in conjunction with regular timber-stand-improvement operations. It requires the removal of trees with infected branches or with large branches, even though they are the dominant individuals of the stand. By pruning trees less than 7 inches in diameter to a height of 17 feet, the number of rotten first logs can be materially reduced by the time the timber is ready for cutting.

Tobacco growers generally depend each year on new virgin-land locations for their tobacco beds in order to avoid weeds and diseases. They sow excessively large beds and yet are never certain of an adequate plant supply at the proper time. Shortage of suitable land and new problems such as blue mold point to the advantage of permanent, easily accessible bed locations where adverse conditions could be better controlled. A stationary steam boiler with a perma-

nent buried tile system of sterilization has proved to be effective as a control measure. It requires no more time than the old pan method of sterilization; it heats the soil to greater depths, which is important in controlling the root knot nematode; it can be used either for frost protection or to hasten the growth of plants, and facilitates control of blue mold by the use of either heat or gas. These advantages offset the greater cost involved.

Problems of Irrigation Farming

Irrigation districts in California are taking measures to improve the quality of their irrigation waters either by eliminating boron-contaminated water or by blending such supplies with good water in sufficient quantity to dilute the contamination to subtoxic concentrations. These measures are based on the results of research on boron and other toxic substances that affect the quality of water used in the irrigation of various crops, especially citrus.

Approximately half the arable lands of the United States have not enough rainfall. In the agricultural use of these lands this deficiency often becomes the determining factor. Only a limited number of crops are suited to dry farming with its special tillage requirements. In extensive areas seasonal grazing with livestock is the only practicable type of agriculture. Irrigation must always be limited to relatively small areas near streams replenished from mountain watersheds or to still smaller areas where underground waters are available.

In relation to the utilization of our arid land resources, irrigation agriculture has an importance vastly greater than its small area would indicate. Irrigated areas contribute to the stability of surrounding larger areas of dry-farming and grazing land. In such a situation irrigated agriculture yields products that supplement those of the dry farms and ranges and make the existence of the latter possible. Moreover, the irrigated areas serve as refuges in periods of drought, and as local centers from which the dry farms and ranges may be reoccupied when favorable weather returns. Without these small scattered irrigated areas, it would be difficult or even impossible to carry on a large part of the dry-farming, stock-raising, lumbering, and mining operations of the Western States.

Allocation of Costs

Public interest in the economic and social interrelationships of irrigation agriculture has found expression in laws which have provided public funds for irrigation development, and also in the assessment of taxes within irrigation districts to liquidate the costs of irrigation. But the equitable allocation of irrigation costs is a problem not yet solved. Confusion and disagreement persist in respect to it. It is generally accepted that the public and the individual irrigation operator should both contribute, but there is no

agreement as to how the burden should be shared. The formula of capacity to pay has frequently been unacceptable.

Another aspect of the problem relates to the assessment of current obligations among the individual operators of an irrigation district. The obvious and most convenient method is to assess each operator in proportion to the area of land he controls or uses. But this method is unsound and generally unacceptable, because it does not allow for differences in the productivity of the soil. Opinion leans toward the periodical appraisal of land units, with assessments based on the appraised values. Then there is the question of joint liability. Contracts of indebtedness under which the dues of defaulting individuals fall upon the nondefaulting members of the district have been widely used in recent years, and have come in for severe criticism.

Irrigation farmers know that irrigation does not necessarily insure good crops. There are many causes of crop failure, of which drought is only one. Insect pest, plant diseases, weeds, and storms of wind and hail are not less prevalent on irrigated lands than elsewhere. Not all irrigated land is fertile. Even fertile land may be unproductive under irrigation because of inadequate drainage, or the use of saline irrigation water. Furthermore, the labor costs of crop production are nearly always higher on irrigated land than on land where irrigation is not required. Ditches or other conduits for the distribution of water to the crops must be constructed and maintained. Frequently the land must be leveled. Irrigation farming requires capital, industry, and skill.

Irrigation is not Drought Insurance

Moreover, irrigation does not insure against drought. In long periods of low rainfall and of deficient winter snows, the run-off from the watersheds declines, and the water supply may be inadequate for the irrigated lands. This condition may be aggravated by the overexpansion of irrigated areas. In general, the areas it is possible to irrigate are greater than can be covered adequately with the potential water supplies. There is a strong temptation to extend the irrigated area in periods when water is available. During the drier periods the water supply is short and the crops are reduced or fail. Such water shortages will occur oftener and more generally as we more fully develop our irrigation resources.

Opinions differ among irrigators and others as to the quantities of water that are adequate for irrigation. Irrigated lands need drainage. This fact makes some people think there is excessive use of irrigation water. Much public sentiment for the overexpansion of irrigated areas draws support from the assumption that the waterlogging of irrigated land is caused by excessive irrigation, and that the need and expense of drainage could be avoided by the sparing use of water. Abundant evidence indicates (1) that in many if not in most situations subsoil waterlogging is caused by the seepage of

water from unlined canals rather than by the excessive application of water to the fields, and (2) that because irrigation water contains dissolved salts, soil leaching and drainage are essential to the sustained productivity of irrigated land.

SOCIAL OBJECTIVES OF FORESTRY

Forest conservation as a public policy has to do with trees, but its basic purpose is social. In dealing with forest lands and their resources in public and private ownership, the Forest Service regards them as tools in the service of the general welfare.

The President's message of March 14, 1938, to Congress, was concerned with forest lands, which make up almost one-third of all the land in the continental United States. It emphasized that forests "are intimately tied into our whole social and economic life," that "some way must be found to make forest lands and forest resources contribute * * * to the security and stability of all our people" and that the forest problem "is a part of the broad problem of modern agriculture that is common to every part of the country."

Calling attention to the fact that the best four-fifths of all our commercially valuable forest land, and nine-tenths of all the potential forest-growing capacity, is now in private ownership, and that much of it has been and is being abused, the message recommended study by a joint committee of the Congress itself to provide the basis for essential legislation during the next session of Congress. It declared: "The public has certain responsibilities and obligations with respect to private forest lands," and added that "so also have private owners with respect to the broad public interests in those same lands."

The plan of action suggested in the message is based on human needs apart from which forest utilization and conservation have no meaning. Its essentials are (1) public (State and Federal) cooperation, (2) public regulation, (3) extension of public ownership and public management.

The first national forests were created in 1891. Federal ownership and management of forest lands received reaffirmation as a public policy under the Weeks law of 1911, and the Clarke-McNary Act of 1924. The area purchased to date under the Weeks law and the Clarke-McNary Act is 15,672,847 acres. In the fiscal year 1938 the National Forest Reservation Commission approved for purchase 800,113 acres for a total of $2,712,762. During the year 1,433,314 acres were vested in public ownership.

National Forests in 1938

As of June 30, 1938, there were 157 national forests, plus 35 established purchase units approved by the National Forest Reservation Commission. Including certain areas transferred by departmental authority, the gross area (public and privately owned) within the national-forest system was 227,507,812 acres. Including lands in

course of purchase, the net area owned by the Government was 175,971,599 acres. The national forests vary in size, as do the ranger districts within each national forest.

Lightning caused 5,470 fires in the national forests during the calendar year 1937, and 6,195 fires were man-caused despite planned and continuous fire-prevention work. Losses by fire for the national-forest system as a whole, however, averaged only 500 acres burned per 1,000,000 acres protected. Never before had they been so low. But forest-fire suppression took the heaviest toll of life since 1910; 20 men died on fire lines or of injuries received there.

Epidemics of insects and diseases often cause heavy forest damage. Insect- and disease-control measures during the year were applied to 421,000 acres of the national forests. Such treatment has been extended up to the present to 2,152,669 acres. About 1,775,338 acres of five-needled pine-producing lands still need similar treatment.

Nearly all the major and numerous minor streams west of the Great Plains head in national forests. Water from protected national-forest slopes is used (1) for domestic purposes by more than 400 cities and towns with a total population in excess of 6 millions of people; (2) for irrigation (11 Western States had, according to the 1930 census, an investment of some 932 millions of dollars in irrigation enterprises); (3) for power (there is more than 11 million horsepower, developed and potential, in the national forests). Forest policy makes water conservation and control a principal objective. On watersheds where floods begin well-conditioned forest soils help retard the run-off. In coordination with the War Department, the Department of Agriculture applies conservation measures to many watersheds. These measures include regrassing and reforestation, the construction of small check dams and reservoirs, and efforts to increase and maintain the existing forest and other vegetative cover.

Economic and Recreational Uses

Administration of the national forests affords much employment and contributes to community welfare. One indication is the fact that of 21,916 timber sales made in the fiscal year, 20,440 were for $500 or less. Small sales of this kind make forest resources available to individuals and local concerns, that may have little capital. To increase the productivity of the national-forest lands, 136,809,000 nursery-raised trees were planted on 155,744 acres, and 8,769 acres were reforested by direct seeding.

National-forest forage is cropped on a sustained-yield basis. In the calendar year 1937, 19,497 pay permits were issued for 1,254,425 cattle, 29,499 horses, and 241 swine: also 5,652 permits for 5,477,351 sheep and 7,603 goats. In addition, 29,833 cattle, 41,821 horses, 11,067 sheep, and 1,039 goats used for domestic purposes were grazed free of charge. The permit system combines forage utilization with the conservation and renewal of the forage resources.

Forage on 40 percent of all Federally owned national-forest lands, unused by domestic stock, is available for the exclusive use of big

game. Big-game populations, which also use much of the 60 percent grazed by domestic stock, have increased nearly 150 percent since 1924 despite open hunting seasons. With more winter range (now lacking), wider game distribution, and better game management, there is room for much more big game on most national forests, and wildlife may become increasingly valuable as a national-forest resource.

The forests are important in recreation. More than 30 million visits were made to national forests during 1937 by sightseers, campers, picnickers, resort and summer-home visitors, hunters, fishermen, hikers, horseback riders, mountain climbers, winter-sports enthusiasts, and other nature lovers. Most of the visitors stopped at one or more of the 3,800 free public campgrounds. They traveled well-built roads and trails, and visited streams and lake shores zoned against timber cutting, livestock grazing, and commercial enterprise.

There are about 185 million acres of farm-owned forest lands in the continental United States. The annual yield from them is about equal to the combined yearly crops of barley, rye, rice, and flaxseed. Like other forests in private ownership, most farm forests have been abused and yield less than they should. Congress has for years recognized that farm forests require special treatment, and has provided Federal aid to States for raising and distributing forest trees for farms. In 1937 Congress passed the Norris-Doxey Act. This contemplated added recognition to the vital part farm forests play in our agricultural economy. It authorizes not to exceed $2,500,000 of Federal funds in any one year. As yet, however, no appropriation under it has been made.

DEVELOPMENTS IN ANIMAL INDUSTRY

Search for superior types of livestock combined with breeding to perpetuate desirable qualities has been directed toward the following objectives: (1) The development of inbred strains homozygous for characteristics of economic importance; (2) testing the merits of cross-breeding for the production of market animals; (3) the development of new and superior strains by means of hybridization followed by selection and inbreeding; and (4) the development of techniques and indexes that will make possible a more definite evaluation of breeding animals. Department research in these fields has revealed wide variation in the performance of individual animals and strains within the various breeds, and has emphasized the need for breeding systems to control this inherent variability.

Beef-cattle research has shown that inherited differences in the performance of progeny of different sires can be readily measured by the amount and economy of gains. At the Agricultural Research Center, Beltsville, Md., the progeny sired by bulls of one strain of beef Shorthorns averaged 17.24 pounds of gain for 100 pounds of digestible nutrients consumed, whereas those of another strain averaged

but 15.37 pounds. There was a significant difference also between the progeny of a sire and his three-quarter brother.

In the Department's work to develop cattle that will produce beef profitably under adverse conditions of heat and insect pests, cross-breeding results with Brahman and Aberdeen Angus cattle indicate the value of having the Brahman blood on the female side. Calves of three-fourths Angus and one-fourth Brahman breeding (offspring of an Angus bull and half-bred cows) reached weaning weight 23 days earlier than calves having the same percentage of Brahman breeding on the male side. The better performance of the quarter-bred calves having part-Brahman dams is attributed to the superior milking qualities of such animals over purebred Angus cows.

In a cross-breeding experiment with Red Polled cows and Red Danish bulls at Brooksville, Fla., the cross-bred calves weighed more at birth, at 56 days, and at 140 days of age than the purebred Red Polled calves produced under the same conditions.

Encouraging progress has been made in the artificial insemination in sheep. Ram semen was shipped by air and rail express from Dubois to Moscow, Idaho, a distance of about 700 miles. Three ewes were successfully impregnated and produced two single lambs and a set of twins. Some of the semen used in successfully effecting pregnancy was as much as 44 hours old. Ram semen was also sent by similar methods of transportation from Beltsville, Md., to Moscow, Idaho, a distance of approximately 2,600 miles. Five ewes were successfully impregnated and produced five lambs. Four of these pregnancies resulted from inseminations with semen less than 48 hours old, whereas in the fifth case it was 72 hours old. These results show the possibility of increasing the usefulness of rams that are especially meritorious.

In experiments with the Danish Landrace and certain American breeds of swine, the Department's investigators have produced cross-bred hogs, obtained by two generations of alternate backcrosses that combined desirable qualities in which the parent strains differed. The cross-bred hogs also raised the level of the qualities in which they were similar. The experimental data show very creditable performance in size of litters, feed-lot gains, and economy in feed consumption. The results point to good prospects for developing and maintaining strains of hogs superior in the characteristics mentioned and others of related economic importance.

Animal Nutrition

Research continues to show the great value of properly compounded rations and feeds containing vitamins, minerals, and related nutritive factors. It shows also the need for further information on the nutritive value of feeds and the recognition and detection of the early stages of nutritional deficiencies.

In cattle-fattening experiments in cooperation with the Texas Agricultural Experiment Station a ration containing only cottonseed meal

and hulls resulted in a vitamin A deficiency, the first evidence of which was night blindness. This condition was followed by a general debility and, in extreme cases, by swelling at the joints, excessive discharges from the eyes and nose, and convulsions. Impaired night vision has been the most practical means, thus far, of detecting the early development of vitamin A deficiency. The experiment showed that the effects of vitamin A deficiency, if not too far advanced, may be corrected to a large extent by the addition to the ration of relatively small quantities of good-quality, green, leafy alfalfa hay such as of U. S. No. 1 grade.

The results of winter feeding trials with fall-farrowed pigs indicate that ground alfalfa hay may constitute up to 20 percent of a well-balanced ration, with good results both in rate and in economy of gain. Less feed was required, however, per unit of gain when somewhat smaller quantities of the ground alfalfa were fed. The purpose of including the hay is to provide the constituents of green feed that are particularly needed when fresh herbage is not available.

In poultry production, low hatchability of eggs exacts a heavy toll each year. In studies at the Agricultural Research Center, the eggs of chickens given access to direct sunshine improved in hatchability even though there was an adequate supply of vitamin D in their diet. This is additional evidence that sunshine supplies something of value for normal reproduction and health other than its antirachitic effect.

National Poultry Improvement Plan Proves Effective

For 3 years now the Department has been cooperating with official State agencies in the administration of the National Poultry Improvement Plan. Breeders and hatcherymen in 42 States have enrolled in this voluntary undertaking to improve the breeding and production qualities of poultry and to control chick losses from pullorum disease.

Participation in the plan last year reached a total of 1,478 breeders and commercial hatcherymen, whose hatcheries had a capacity of more than 60,500,000 eggs. This represents about a sixth of the hatcheries and a fourth of the total hatching-egg capacity in the cooperating States. Eggs for these hatcheries were obtained from more than 28,000 flock owners who followed the provisions of the plan in selecting and testing 6,000,000 breeding birds.

Approximately 300 poultry breeders are trap-nesting more than 100,000 birds under official supervision in conformity with the plan. The birds used in nearly 2,000 individual matings were from high-producing blood lines, the males being from 225-egg stock and the females all having annual records of 200 eggs or more.

The benefits accruing to poultrymen participating in the improvement plan include more efficient methods of flock selection, control of pullorum disease, and systematic progeny testing.

Tracing Animal Disease to Its Source

The germs that cause tuberculosis and other animal diseases are too small to be seen except with a powerful microscope. Yet veterinary inspectors of the Department have been able to trace these microscopic enemies of livestock long distances from market centers, back even to barns and pastures in stock-growing regions. This activity supplements regular tuberculin testing and other well-established field work for the control of animal diseases. The key to this additional disease-detection system is a record form used in reporting the origin of diseased animals found in shipments at market centers where the animals are slaughtered under Federal meat inspection.

Last year this system revealed the origin of 938 tuberculous cattle and 1,649 tuberculous swine received in a total of more than 700 shipments. The animals in question were not suspected of being tuberculous until slaughtered. They came from a wide range of producing areas in the United States. In the past the main obstacle encountered in the plan has been the difficulty of tracing the origin of shipments that change ownership several times, and also mixed shipments containing animals from several owners. However, through the increasing use of eartags, tattoo marks, and similar means of identification, the Department has more than doubled, in recent years, the number of cases of diseased animals successfully traced. Maladies that have received special consideration are tuberculosis, hog cholera, and parasitic infections.

Bang's Disease Control

Bang's disease, or infectious abortion, of cattle causes more losses in the United States than any other livestock disease. After the first outbreak in a herd, so many animals become carriers of the germ that complete eradication of the infection is difficult without systematic procedures. For the control of Bang's disease, a combined State and Federal project is now in its fourth year; it consists of the testing and slaughter of infected animals and the application of strict sanitary measures.

Extensive public interest has developed in the eradication work. Blood tests to detect the disease were applied during the fiscal year to 7,837,363 cattle, of which 324,532, or 4.1 percent, reacted. At the close of the year approximately 9,500,000 cattle were under supervision in the project, and 1,000,000 more were on the waiting list. A large amount of work was done under the area plan. In about 275 counties distributed among 22 States, all breeding cattle over 6 months of age have been tested. The owners of reacting cattle in 14 States now receive a State payment in addition to the Federal payment for reactors. They also receive the salvage. Additional States will probably make arrangements to pay cattle owners for reactors to Bang's disease when the legislatures meet.

Vaccination gives promise of helping to control Bang's disease. After many years' research the Department and the cooperating agencies found experimentally that cows vaccinated during calfhood show a high degree of resistance under conditions that cause a large majority of unvaccinated animals to abort. The vaccine is prepared from a strain of the abortion organism of reduced virulence. For the last 3 years the Department has furnished this vaccine to officials for trial in herds known to be seriously infected. Preliminary results have shown that calfhood vaccination gives reasonable protection under farm conditions, but this phase of Bang's disease control is still in the experimental stage.

Tuberculosis Eradication Protects Health—Averts Losses

Since July 1, 1937, three additional States—New Jersey, New York, and South Dakota—have been added to the modified tuberculosis-free accredited area. This term signifies the reduction of bovine tuberculosis to less than one-half percent and the removal of all reactors to official tuberculin tests. Only one State, California, now remains outside of this status of practical freedom from bovine tuberculosis. The work is progressing in a satisfactory manner in most of the remaining 14 counties of that State.

It is necessary to retest herds of cattle to locate and eradicate any remaining infection. During the year the combined forces of the States and Federal Government applied tuberculin tests to about 14,000,000 cattle. Of this number close to 90,000, or about 0.6 percent of the total, were found to be reactors.

The number of cattle and swine showing evidence of tuberculosis, on post-mortem examination at Federally inspected establishments, has become steadily less in recent years. This is conclusive evidence of the effectiveness of cooperative tuberculosis-eradication work. The successful conquest over bovine tuberculosis not only removes a great danger to human health, but also averts great economic losses to the livestock and dairy industries.

Serious Horse Disease

The appearance of equine encephalomyelitis in extensive areas in 1937 was the cause of concern among farmers and other horsemen. The Department received reports of more than 169,000 cases of this disease distributed among 30 States. Deaths of affected animals averaged about 25 percent, in addition to which the epizootic greatly impaired the usefulness of farm work stock. The disease, which is caused by a virus, normally is at its height during late summer and early fall months.

Studies in the Department and elsewhere point to the value of simple, practical measures in preventing infection and reducing losses. Mosquitoes, and possibly other bloodsucking insects, are believed to carry the disease from horse to horse. The Department, therefore, recommends stabling of horses not in use, screening, spraying with repellents, and general hygienic precautions.

Numerous army posts and several breeding establishments as well as some small farms have completely avoided the disease or suffered only minor losses, apparently by these means alone.

In addition, the Department has developed a vaccine, treated with formalin to eliminate danger of spreading the disease. The vaccine, as made commercially, has been more and more widely used each year. In 1937, according to Department estimates, 100,000 horses were vaccinated with apparent advantage in lessening the number of cases and lowering mortality. To allay fear and limit quackery as much as possible, the Department has disseminated reliable up-to-date information concerning the malady, with gratifying results.

SURVEYS SHOW CONSUMPTION TRENDS AND NEEDS

The Nation's resources include the people as well as the land, trees, and minerals. Indeed, the real aim of conservation is to safeguard and develop human beings. Needless to say, many governmental agencies contribute to this aim. The Bureau of Home Economics has a unique responsibility in this enterprise; it is the only bureau in this Department that focuses its entire program of research and education on the conservation and development of human resources. It endeavors to determine human needs for food, clothing, housing, and other goods and services, and to acquaint both producers and consumers with the requirements. The Bureau's research looks for answers to such questions as What is good nutrition? What food and how much does one need? What proportion of the population gets an adequate diet? How may consumers get better results in general for their expenditure? Answers to these questions, besides directly promoting human welfare, help to establish both the science and the art of consumption, and at the same time to help in local and national planning for well-adjusted, efficient production and good land use.

Important investigations in the Bureau have to do with housing and with its bearing on health and family life. They seek to determine what sort of homes best suit the needs of present-day living. Other studies deal with the equipment of dwellings, the use of electricity, and sanitary facilities. Related educational programs assist homemakers to choose household equipment and furnishings wisely. Similar work provides information useful to consumers in buying textiles and clothing. These studies show the various qualities of wool and cotton that best suit different uses and indicate various possibilities for using fibers more effectively. Such investigations interest producers as well as consumers. Sometimes they indicate new economic opportunities to farmers and manufacturers and suggest useful modifications in existing production methods and goals. The ultimate test of production is the contribution it makes to human welfare. But the most efficient production misses the goal if the consumption of products is not efficient.

This Department in cooperation with other public agencies is investigating the kind and quality of living that the Nation's families obtain in various regions and social conditions. The resulting information indicates both achievements and requirements. It compares actual family-living conditions with the requirements of generally accepted American standards. It deals particularly with the sources of income and the expenditures of American-born families of different income levels. Family income is a rough index of potential family well-being, because of its close relationship to consumption patterns. The cooperating agencies are the Departments of Agriculture and Labor, the National Resources Committee, the Central Statistical Board, and the Works Progress Administration. The Bueau of Home Economics has responsibility for the work in 64 farm counties comprising 23 type-of-farming areas, 140 villages, and 19 small cities.

Significant Data Gathered

Much extremely significant information already has been obtained. For example, the study showed that in 1935–36 the income levels of native white families in small cities were usually higher than those of similar families living in villages and on farms. But differences in family-income levels were greater among geographic regions and even among communities of the same type such as cities than any consistent differences that existed between city and farm or between farm and village.

Another extremely important kind of information revealed by the study concerns the nonmoney income of farm families—the income from home-grown food and fuel and the value of farm housing. With the value of farm-furnished products added to their money income, the families of farm operators in the Middle Atlantic and North Central region and in the Pacific coast region tended to have higher total incomes in 1935–36 than did the village families in the same regions.

Nonmoney farm income is an extremely important factor in the security and health of the farm family. Food and shelter from the farm, and sometimes fuel from the farm wood lot, are vital farm safeguards against economic storms. Farm-furnished goods received by the families of white farm operators varied, for the country as a whole, between $668 in North Carolina and $321 in southern California. On the lowest plane of farm family living, the kitchen garden and barnyard keep the wolf from the door. The lower the average yearly income, the more important are these sources of family supplies.

Some of the requirements of the study, for example the rule that it should include only the families of operators that had occupied their farms for a year, tended to eliminate some of the low-income groups, and to present a more optimistic picture than would have resulted from a study of all the families in the areas covered. Moreover, the areas chosen were areas well adapted to specific types of

farming, and as such often consisted of the better farm land. Yet in none of the 23 areas chosen did more than half of the families of native-white farm operators have net yearly incomes of more than $1,587. This average included both cash income and the estimated equivalent of the nonmoney income.

In 2 counties of Vermont the median income of 543 such families was $1,142. In 18 counties in 7 Middle Atlantic and North Central States, namely, New Jersey, Pennsylvania, Ohio, Michigan, Wisconsin, Illinois, and Iowa, the investigators found the highest median income, $1,503, for the families in Illinois. They found the lowest median income in this group of States for families of Iowa, in an area which had been hard hit by bad crop conditions. The median income there was only $936. Three separate studies of farm families in the Plains and Mountain regions showed the effects of the drought. Families on North Dakota wheatlands had a median income of $593. Farm families in wheat counties of Kansas had a median income of $732. Families in the range livestock counties of Colorado, Montana, and South Dakota had a median income of $731. On the Pacific coast farm families in Washington had the lowest median income, $1,039. Two counties in southern California, where the chief farm products are fruit and nuts, had the highest median income for the Pacific coast region, namely $1,475. The sharpest contrasts developed in the southeastern region between sharecroppers and operators and between white and Negro families.

Patterns of Rural Consumption

Patterns of rural consumption indicate the kind of living that farm families want. In this connection the studies brought out much interesting information. They helped to show, for example, how much of their income farm families use for current living and how much for getting ahead financially. Farm families in the $1,000 to $1,249 income class in Pennsylvania and Ohio increased their net worth in 1935–36. So likewise did farm families in the $1,250 to $1,499 income class in Illinois, Iowa, Kansas, and North Dakota; and in the $1,500 to $1,749 income class in California. At the lower end of the scale families with low-income levels decreased their assets or increased their liabilities. They encroached on their capital for subsistence. In between, among families with net incomes between $500 and $1,000, there was a departure from the mere balancing of living expenditures with incomes, and a beginning in the liquidation of debt or the increase of assets. Wherever the family income left a margin for getting ahead financially the margin tended to go into payments on the principal of the farm mortgage, into life insurance, into increased bank accounts, and into investments in the farm business.

In expenditure for family living the study indicated the growing prominence of the automobile. The farm family of today must have its car, both for social contacts and as an aid to the farm business.

Farm families get less than do city and village families in the way of running water, electric lights, central heating, and other modern home equipment. But there is wide regional variation in this respect. For example, 75 percent of the farm homes surveyed in California had hot and cold water in kitchen and bath, as compared with only 5 percent in the Southeast. Farm houses on the West coast were smaller than the States to the east and north but more of them had up-to-date equipment.

In all areas the diets of farm families surpassed the diets of village and city dwellers, largely as a result of the farm family's production for its own use. The value of the food produced on the farm for the family table increases with the family's income. It does not reach the upper limit, which results from the limitation of the family's capacity to consume, until the family income is relatively high. On most farms there is still room for a considerable increase in production for the farm table.

Investigations in City Living

Equally significant for agriculture were the results of investigations in city living. These inquiries showed that the diets of families of employed wage earners and of low-salaried workers are often very inadequate. Need of improvement was indicated in 40 to 60 percent of the white families in four regions, and in more than 60 percent of the Negro families in the South. None of these families had been on relief during the previous year. All of them had incomes of at least $500. Corroborative data resulted from study of diets of nonrelief families in villages where the nutrition levels were still less adequate. Significantly, the poor diets found in various communities showed a direct correlation with the prevalence of disease. Farm families had better health on the average, as well as better diets, than families in villages or cities.

Even among urban families with enough income, many do not obtain a fully adequate diet. Thus, the study indicated that out of every 10 families that spend enough money for a good diet only 2 to 4 selected good diets. Among the Negro families in the South the proportion that selected good diets was 3 out of 10. These findings disclose a double need with regard to urban nutrition—need for more income, and need for more education concerning nutrition and food buying. Families of city wage earners whose diets rated good from the standpoint of nutrition bought more eggs, milk, and fruits and vegetables than the average for the wage-earner group. These are the more expensive items in the dietary. They bulk larger in it as the family income rises. Obviously, the best way to improve the Nation's diet, and at the same time to improve the market for agricultural products, is to raise the income of the groups at the lower level and at the same time to furnish them increased information as to the essentials of adequate diets.

PROGRESS IN INSECT PEST CONTROL

This Department is trying to improve materials and methods used in combating insects by the use of chemicals. The investigations follow two main lines, one concerned with the improvement of commonly used insecticides, and the other with the development of new insecticides. In the development of new insecticides the investigators give special attention to determining and developing the toxic constituents of natural plant products, and to developing toxic compounds by synthesis. Chemists have developed many hundreds of materials, and the Department has requested public-service patents for those that are promising.

An improved method of determining the particle-size distribution in powdered solid insecticidal materials has been developed. It has disclosed great differences in otherwise similar commercial products. There is significant correlation between particle size and toxicity. This development may lead to greater uniformity in commercial insecticidal materials. The recent development of a method of determining minute quantities of nicotine has greatly facilitated investigations to extend the use of insecticides made from tobacco. This method enables the specialist accurately to determine the amount of nicotine deposited on a single apple, and makes it possible to ascertain the possible health hazard from such residues as well as to determine exactly the amount of deposit required to protect the fruit from insect pests.

Nicotine is becoming more important as an insecticide, and the Department is testing various insecticides in which it is the toxic ingredient. Nicotine bentonite, one of the compounds developed by the Department, holds promise as a substitute for lead arsenate for the control of the codling moth, particularly in the Middle West where it is now being used rather extensively. The alkalinity of fungicides now commonly used for the control of plant diseases reduces the effectiveness of the nicotine bentonite, and its general use may be delayed until fungicides compatible with it are developed. The extended use of insecticides derived from tobacco is of interest in connection with the search for new uses for surplus tobacco.

Extensive laboratory and field tests have been continued with insecticides containing rotenone derived principally from such plants as derris, cube, and timbo. Insecticides from these sources do not leave hazardous residues and are being more extensively used for the control of many insect pests that attack truck and garden crops. Available information does not indicate that they are applicable to all kinds of pests. Earlier studies suggested that rotenone-bearing insecticides retain their toxicity for only a short period. Recent studies have demonstrated, however, that the active ingredients of derris are translocated in bean plants in such a manner as to prevent extensive feeding by the Mexican bean beetle. Investigations to devise more effective carriers and adhesives for insecticides containing

rotenone indicate that insecticidal materials of this type can be effectively used against many insects. Noteworthy results have been obtained with dusts and sprays containing rotenone in combating the pea weevil and pea aphid. In the Northwest, where peas are grown for canning, general infestations of the pea weevil have been reduced by 95 percent through the application of a rotenone-bearing dust mixture recently developed by Department specialists.

New Lines of Experiment

Research has developed strains of certain crop plants that are resistant or tolerant to attack by their more important insect pests. This method of combating insects may be as successful eventually as similar methods have been with some of the important plant diseases. Varieties of alfalfa have been developed that are highly resistant to the alfalfa aphid and types of wheat that are highly resistant to the hessian fly. Tests of wheat varieties suitable to conditions in the Pacific coast region indicate that certain resistant strains will be commercially available before long. Varieties of corn tolerant to the European corn borer are being developed. Progress has been made in the development of strains of sorghum that are resistant to the chinch bug.

Search continues for better methods to control the insect pests of cotton. Besides the boll weevil and other outstanding pests, this work deals with native cotton insects that greatly reduce the yields. Losses caused by insects less conspicuous than the boll weevil, the bollworm, and the cotton leaf worm should not be overlooked. Sucking bugs materially reduce the yield and lower the quality of the fiber. Much progress has been made in developing control measures for these pests. Mixtures of sulphur and paris green or sulphur and calcium arsenate have proved effective. Experiments showed that the use of these newly developed mixtures will very greatly improve the yields as well as the quality of cotton. One test gave an increase in yield of 99 percent, or a gain of more than 2,300 pounds of seed cotton per acre, as compared with the yield from adjacent undusted cotton.

Rotary-type aircraft, such as the autogiro, help entomologists locate trees that may be affected by plant pests. Aircraft of this type have been useful aids in scouting for a number of plant pests and are extensively used to locate the possible presence of the Dutch elm disease. They have been tested as a means of distributing insecticides for the control of tree insects. Methods have been developed that make it possible to use such aircraft to distribute insecticides effectively at a comparatively low cost. Improvement of these methods will lead to the more extended use of aircraft in the distribution of sprays, and may make it economically possible to control outbreaks of certain injurious forest insects.

The Department has developed means of injecting liquid preservative materials into living trees so as to kill primary insects and prevent infestation by secondary pests and the accompanying rapid

decay. A description of the method has been published. It is especially applicable to timbers for fence posts and rustic work, and will permit the use of wood from pines, especially in the southern States, and from other trees that without treatment quickly decay. It should be of great benefit in the southern States where durable woods are not readily available. It has been adopted also in efforts to eradicate the Dutch elm disease. Many elm trees have been treated with chemicals to make them unsuitable as breeding places for the beetles that carry the disease.

Experiments in the use of penetrating oils to kill bark beetles and certain wood borers have indicated a method of treating infested trees. The new method is effective for the control of the mountain pine beetle in lodgepole pines. Control measures can be applied to outbreaks of this pest during the summer period.

Studies of bark beetle outbreaks have developed a method of classifying pine trees and pine stands as to their relative susceptibility to attack by the western pine beetle. This method is being tested in cooperative control work. Large sections of valuable timber in California have been classified. The grouping shows where control and logging operations should be carried on so that timber may be harvested before bark beetle outbreaks destroy its value. Also it determines the conditions under which control operations can be carried on with good results.

Giving the newly developed insecticide, phenothizaine, to cattle with their food makes the manure unsuitable for breeding the horn fly, an important widespread pest of cattle that also causes conditions favorable for screwworm attack. This new and unusual method, the result of screwworm investigations, opens up a promising field. Results so far have been particularly valuable in range areas, where horn flies are serious pests and other methods of control are not applicable. There is a direct relationship between the alkalinity of the wounds and their attractiveness to screwworms and other blowflies. Investigations showed that wounds attractive to flies have alkaline or nearly neutral exudations. Practically all the animals on which the secretion from the wounds remained alkaline after the attack by the screwworm died. These discoveries apply directly to the treatment of wounds caused by insects and the development of fly repellents, and the application may extend to other methods of treating wounds.

Natural Enemies of Insect Pests

Efforts to increase the natural enemies of insect pests are an important phase of the Department's work. They include search in foreign countries for the natural enemies of introduced pests. Satisfactory cooperative relations with various governments in Europe and in the Orient have aided the work. As part of this cooperative program the Department this year shipped beneficial insects to Canada, the Canary Islands, Egypt, Mexico, Peru, and Uruguay.

The citrus blackfly, an important citrus pest, not present in the United States, has long been established in the Bahamas and in parts of the West Indies. Cooperative efforts introduced natural enemies of it into Cuba a number of years ago, and brought about its effective control there and reduced the risk of its getting into Florida. One of the parasites of the blackfly has been established, and another of its natural enemies, a predacious beetle, has been introduced in the Bahamas. More than 38,000 specimens of 14 species of parasites of the oriental fruit moth have been imported from Japan and Chosen and liberated in the infested area in the United States. These introduced parasites, and others native in parts of the infested area, are effectively controlling the pest in many peach-growing districts. In areas where the parasites have been established for a number of years, they kill 70 percent or more of the oriental fruit moth larvae.

Inspections during November 1937, disclosed a light infestation of the pink bollworm in the Santa Cruz Valley in Arizona, and required an extension of the Federal quarantine. This new infestation is near the Salt River Valley, where a heavier infestation had been eradicated.

Efforts were continued to eliminate the light infestation of the pink bollworm found last season in the lower Rio Grande Valley of Texas. Inspections this season disclosed light infestations near Corpus Christi. It will be necessary to extend the regulatory and control operations. Infestation by the pink bollworm was high in a limited area in the Big Bend section of Texas during 1937. It menaced the remainder of the Cotton Belt.

Thirty-one first-record infestations of the Japanese beetle were discovered in 1937. Many of them, however, did not require an extension of the quarantine; comparatively little new area was added to the regulated area. Control work continued in cooperation with the States in isolated outlying areas of infestations.Only a single beetle was found in St. Louis during 1937; control measures previously applied there had been effective.

Efforts to suppress the white-fringed beetle, a new pest discovered last year in limited areas in four Southern States, were continued. This pest feeds on many plants including several important crops. It is important to agricultural interests over wide areas. It reproduces without mating. A single living adult can establish an infestation. Surveys during 1938 disclosed the pest in some new areas, but the known infested section is relatively small.

Inspections of elms to determine the possible presence of the Dutch elm disease during the season of 1937 revealed many fewer trees affected with this disease than were found in 1936. The number of infected trees found was 25 percent less. First-record infections were limited to Athens, Ohio, and Wiley Ford, W. Va. The main infected area is, however, still confined to a territory within a radius of 50 miles of New York City.

Investigation showed that in some cases light infections of this disease may remain dormant in the tree for a number of years.

Eradication of the disease, which threatens the elms of the entire country, may require long and intensive effort.

In 1937 the white-pine blister rust disease was found in new localities in California about 120 miles farther south than other known infections. This important disease of white and sugar pines has now reached the vicinity of Mount Lassen in the east and the headwaters of the Trinity River in the Coast Range. It is well within the sugar pine area, the most valuable component of the forests of the Sierra Nevada. Efforts to suppress it have continued, with the assistance of emergency funds. During 1937 the destruction of more than 75,000,000 currant and gooseberry bushes, which are the necessary alternative hosts of the disease, gave protection to over 1,000,000 acres of commercially valuable pine forests.

Experimental work developed methods of treating certain varieties of grapes and certain other deciduous fruits to eliminate possible infestations of the Mediterranean fruitfly. Accordingly, in 1937 the Bureau of Entomology and Plant Quarantine authorized the treatment of fresh fruit while in transit. Under this provision more than 55,000 cases of grapes and a considerable quantity of peaches and plums were imported from South Africa during the year. These were the first importations of such products since the establishment in 1923 of a Federal quarantine that prohibited the entry of most kinds of fruits from countries where the Mediterranean fruitfly is known to occur.

EXTENSION SERVICE EMPHASIZES ECONOMIC INFORMATION

County extension agents working in 2,953 of the Nation's 3,075 counties during 1938 placed greater emphasis on furnishing economic information to farmers and on helping them to plan their operations in terms of all their needs.

More than 2,200 county agricultural planning committees functioned during the year. Organized by county agents and composed largely of leading farm people, these committees analyzed community problems in their relation to national problems and worked out plans for improvement. About half the committees started making land use maps of their counties to show needed long-time adjustments. They cooperated with the Department's land use agencies in coordinated regional and Nation-wide program planning. The Extension Service placed major emphasis on this work with the double object of working out sound land use plans for farm communities and of helping farm people to study and understand various local, State, and national problems.

County agents in 1938 spent about one-fourth of their time explaining and forwarding the A. A. A. program, though they assumed less of the detail work involved than in the previous year. In South Dakota, for example, they helped to organize and conduct 644 community A. A. A. meetings to explain the program. More

than 50,000 farmers, or about 68 percent of all the farmers in the State, attended at least one of these meetings. The county agents helped farmers to understand and use other facilities of the Department, such as the programs of the Farm Security Administration and of the Soil Conservation Service.

These activities supplemented and strengthened the old extension projects. Grants and loans and special payments under the new programs helped farm families to carry out practices that extension workers had long recommended. County extension agents, with help from about 1,500 State extension specialists, conducted in 1938 nearly a million adult result demonstrations in improved farm and home management. More than a million 4-H Club boys and girls completed 1,500,000 projects, such as growing an acre of corn, planting a garden, and improving the home. Nearly 500 Negro extension agents, largely in the South, carried farm and home developments to Negro farmers.

Extension workers helped farmers to fight grasshoppers and chinch bugs in the West, screwworms and boll weevils in the South, Japanese beetles in the East, and many other insects and diseases dangerous to farm crops and livestock. They helped farm families to improve their homes, to do cooperative marketing, to combat droughts and floods, to budget their expenditures, and generally to get better results on the farm and in the home.

The Whole Farm Approach

In practically all States extension workers shifted their emphasis from specialized projects to the whole farm approach. They provided coordinated specialized help to farm people. In Connecticut, for example, extension specialists in dairying, farm management, agronomy, agricultural engineering, and other specialized work developed a coordinated plan to improve income from dairying. Each specialist offered his own contribution as part of a program for reorganizing and improving the entire farm and home management and business set-up.

Similar whole-farm plans are under way in Connecticut for helping farmers with their poultry problems. Extension workers in Texas undertook whole-farm demonstrations in every county. These demonstrations enlisted the cooperation of the entire farm family, the county agent, the home demonstration agent, the farm- and home-management specialists and other specialists. They set forth the goals for which the family should strive. Out of 196 goals set by 20 of the first Texas families to plan such demonstrations, records showed that 194 had been attained, 100 of them on the farm and the rest in the home.

Nearly 500,000 farm people, trained and guided by extension agents, served as local leaders in their communities during the year. They helped train and develop the 4-H Club members, of whom there are more than 1 million. They helped direct the activities of more than 45,000 organized home-demonstration clubs, with a mem-

bership of more than a million farm women, and helped in farmer-cooperative and other educational endeavors.

Approximately $31,000,000 was spent for cooperative extension work during the year, about half of it provided by the Federal Government. The States provided about one-fourth, and county governments and farm organizations furnished the rest of the money. About 75 percent of the Federal money was spent in employing county agricultural and home demonstration agents, and about 18 percent in employing State extension specialists. The remaining 7 percent was spent for publications and administration of the national and State offices.

PERSONNEL ADMINISTRATION

It is essential that the Government have a responsible body of capable and efficient civil servants. As we strive to preserve and strengthen our democratic processes, we shall place more emphasis upon this need. Civil servants should have fair pay, continuity of employment, and favorable conditions for their work. Then Government positions will attract and hold desirable personnel.

This Department was ready with essential economic data accumulated by the Bureau of Agricultural Economics when the time came for the agricultural adjustment program. It had a trained personnel familiar with the problems involved. But there was increased need for persons trained in administration and management. Complex new requirements involved new procedures, methods, and rules. Personnel problems we had believed to be solved presented new angles.

Growth of the Department's functions brings an increased assignment of responsibilities to civil servants, since it is impossible for the Congress to prescribe all the details of administrative procedure. It freshly emphasizes the importance of establishing good conditions for the personnel, and of insuring the continuity of good Government service. This is entirely compatible with the fact that principal executives entrusted with policy-determining responsibilities change with changes in the national administration.

The recruitment, selection, and training of competent personnel in Government constitute an important public investment, and should not be sacrificed to the spoils system. This needs no discussion; our political parties accept the principle. The Executive orders of June 24, 1938, are therefore of great significance to the Department and to the Government generally. They fortify and develop the movement for better personnel administration in the Government service and look toward improvement of the civil service. Many positions will come under the civil service that had to be created quickly to supply needed Government service during the emergency period.

This Department is working to improve personnel recruitment, to train employees for quicker progress toward peak efficiency, to provide opportunities for advancement, and to insure that efficient and

faithful work will be recognized and rewarded. In May, the Department issued Memorandum No. 753, a personnel relations policy and procedure. The introduction stated:

> It is a part of good personnel administration that employees have access to responsible administrative officials for the discussion of individual problems affecting their status and welfare. In an organization as large as this Department it is natural that questions and problems will arise involving personnel relations. Their prompt and orderly consideration and disposition are consistent equally with efficient administration and the desire of employees. * * *
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> Certain fundamentals deserve emphasis. First of all is the fact that the staff of the Department constitutes an organization to carry out a program of public service. Because the Department is an agency of the Sovereign Government, departmental policies and procedures must conform to national policy. * * *

Adjustment of Grievances

Under the new procedure any employee with a grievance which he cannot adjust with supervisors and bureau chiefs or with the Office of Personnel may proceed with a formal appeal, in the first instance within the bureau. The employee and the bureau chief each name a representative; these two agree upon a third member. This group obtains the facts, hears witnesses, and makes recommendations, upon which the bureau chief acts. If the employee is still dissatisfied, he may appeal to the Director of Personnel, who will organize another group of three. This second group will consist of a representative named by the employee, a representative named by the bureau, and a third member selected by the first two. It will make findings of fact and recommendations to the Director of Personnel, who is authorized to act on them. Finally, if the employee desires to take a further step, he may appeal to the Secretary in writing.

This procedure has expedited the disposition of many grievances in a manner generally satisfactory both to employees and administrators. It is important to settle grievances promptly. Delay often affects morale out of all proportion to the weight of the original difficulty. In shaping this plan the Department used the democratic process of conference with all the major interests involved. After a draft had been prepared in the Office of Personnel, the directors, bureau chiefs, other administrators, and employee groups expressed their opinions of it. Representatives of employee unions in the Department, and some employees selected without regard to their affiliation or nonaffiliation with any employee organization, took part in the conferences. The heads of the three national organizations of Government employees participated in the discussions.

Most new employees enter the Department in the lower grades. The quality of the personnel thus brought into the professional service has been greatly improved in recent years. The Department is trying similarly to improve the recruitment for other branches of the service, particularly those who will supply future administrators. Measuring the potentialities of candidates is difficult, but progress is being made with the help of the Civil Service Commission, whose cooperation has been invaluable.

NEW LAW IMPROVES FOOD AND DRUG CONTROL

After 5 years of continuous legislative consideration, the Federal Food, Drug, and Cosmetic Act was finally approved on June 25, 1938. It is a statute of far-reaching importance. It supplants the Food and Drugs Act of June 30, 1906, and greatly increases the protection afforded by that law against practices that affect the public health or result in economic cheats to consumers.

The act of 1906 was in its day regarded as a piece of advanced and progressive legislation. It provided safeguards in reasonably effective fashion against many of the abuses then existing in the food and drug industries. Its enforcement has effected innumerable reforms in these industries and has furnished immeasurable protection to the consuming public. The inadequacies of the original law, however, manifested themselves early in its enforcement history and became more apparent with progress in industry, changes in manufacturing processes, and changes in the economic situation.

Within a decade after it went into effect conditions of American life had changed profoundly. New machinery, new roads, new transportation, and new knowledge in chemistry and physics had worked together to transfer much of the domestic business of food preparation from the home kitchen to the factory. At the same time the manufacture of medicine was largely transferred from the local pharmacy to the factory. New ways of living in small homes with automatic heat and electric power to do the household chores set a large group of American women free from the sun-to-sun household work of their grandmother's day and gave them more time to consider their personal appearance. Promptly a new cosmetic industry came into being, subject to no control under the old law.

While these developments took place in the home and in the food, drug, and cosmetic industries, the apparent scope of action under the Food and Drugs Act of 1906 was narrowed to some degree by court decisions which revealed textual weaknesses not foreseen when the law was enacted. The measure was a compromise of restricted scope, negative rather than positive in its character in that it prohibited false and misleading label claims but made few requirements for informative labels.

Food and drug enforcement officials of the Department long ago recognized the weaknesses of the original statute. Efforts have been made at intervals for many years to obtain legislative amendments. It was not until 1933, however, that a sustained effort was made by the Department to bring about not merely amendment of the old statute but a complete revision, modern in phraseology and procedure and sufficiently comprehensive in scope to effect thoroughgoing public protection. Consumer groups, enlightened trade organizations, and members of Congress gave able support to the food and drug officers in their efforts to procure this needed legislation.

The first comprehensive bill calling for a revision of the statute was introduced in the Senate on June 12, 1933. Strong opposition to

the new legislation developed. Numerous revisions were considered and reconsidered. It was not until June 25, 1938, almost 5 years to the day after the introduction of the original measure, that the new Federal Food, Drug, and Cosmetic Act was approved by the President. The new law retains all of the meritorious features of the Food and Drugs Act of 1906.

Outline of New Provisions

It is unnecessary to catalog all of the new provisions, but a few of the important new features should be mentioned. It brings all cosmetics except toilet soaps under control and outlaws those which may be injurious to health. It assumes jurisdiction over drugs used in the diagnosis of disease and those intended to affect the structure or any function of the body. Reducing drugs, so-called slenderizers, which heretofore have escaped Federal control regardless of their frequently harmful effect upon the user, are now within the scope of Federal control. The new law prohibits traffic in new drugs unless they have been adequately tested to show they are safe for use, and requires that certain habit-forming drugs bear adequate warning labels. It brings therapeutic devices under control. It provides for the establishment of definitions and standards of identity and quality for food products. It sets up more effective safeguards against poisonous foods. It provides increased criminal penalties and modernized enforcement machinery.

While the general provisions of the law become effective on June 25, 1939, at which time the Food and Drugs Act of June 30, 1906, is repealed, certain provisions affecting public health became effective immediately. The effective provisions include prohibition against drugs dangerous to consumers when used as prescribed on the label, and against injurious cosmetics. The Food and Drug Administration, which has had long experience in the enforcement of the act of 1906, will have the responsibility of enforcing the new statute.

LITIGATION AFFECTING THE DEPARTMENT

One of the most important court decisions relating to the work of the Department was rendered by the Supreme Court on April 25, 1938, in the Kansas City commission rate case (*Morgan et al.* v. *United States et al.*, 58 Sup. Ct. 773). This case had its origin in 1930 as a result of an inquiry before an examiner of the Department instituted by the then Secretary of Agriculture pursuant to the provisions of the Packers and Stockyards Act, 1921, for the purpose of determining the reasonableness of the rates of the market agencies engaged in the business of buying and selling livestock on a commission basis at the Kansas City stockyards. After a second hearing before the examiner, which was ordered by the Secretary in 1932, the case was argued before Assistant Secretary Tugwell in March

1933. The present Secretary signed an order in June 1933 whereby a substantial reduction in rates was prescribed.

The market agencies brought suit in the Federal district court to enjoin the enforcement of the order. A temporary injunction was granted on condition that the market agencies should impound with the court the excess charged above the prescribed rates, pending the termination of the litigation. Among other allegations, the market agencies pleaded that they had been denied a full hearing because they had not been permitted to argue the case before the officer who signed the order. On motion of the Government, this allegation was stricken from the bill and the district court later sustained the Secretary's order on its merits. The market agencies then appealed to the Supreme Court and on May 25, 1936, that Court held that it was error for the lower court to strike the allegation from the bill (298 U. S. 468). The Court decided that the Government should be required to answer the allegation and that the lower court should determine whether the appellant had received a proper hearing.

The Government answered the allegation. Thereafter, the case was tried before the district court. That court found that the market agencies had received a full and fair hearing and again sustained the order on its merits. Once more the market agencies appealed to the Supreme Court, which rendered its second decision on April 25, 1938, reversing the decree of the lower court without passing upon the merits of the case. The Court held that there was a vital procedural defect in that the market agencies were not given an opportunity to know the claims of the Government and to present argument thereon. No proposed findings and order had been prepared by the examiner and served on the market agencies before the case was argued before the Assistant Secretary, and the arguments were made upon the basis of the record generally.

A motion for rehearing before the Supreme Court was denied. Following this decision, the Secretary served a copy of proposed findings of fact and order upon the market agencies and a specified time was given in which they might file exceptions thereto. In the meantime, the district court entered an order directing that the impounded money, amounting to more than $600,000, be returned to the market agencies, and denied a motion of the Government to stay further action with respect to the impounded money until the case could be disposed of by the Secretary in accordance with the procedure indicated by the Supreme Court in its opinion. A motion to stay the order of the district court is now pending before the Supreme Court.

It should be noted that, in 1936, the Secretary adopted rules of practice relating to proceedings under the Packers and Stockyards Act. The procedure thus established provides for the issuance by the examiner of a report containing proposed findings of fact and a recommended order, to which the parties may file exceptions and upon which they may make oral argument to the Secretary. Hence, the procedural defect found by the Supreme Court in the Kansas

City case had already been eliminated by the Department at the time of the Court's decision.

On May 31, 1938, the Supreme Court of the United States delivered another important opinion involving the Packers and Stockyards Act. The Court sustained an order of the Secretary prescribing reasonable rates for stockyard services at the Denver Union Stockyard (58 Sup. Ct. 990). Among the questions at issue in this case was the question whether the Secretary erred in failing to include in the rate base a separate allowance for going concern value. In making his finding of fair value to be used as a rate base, the Secretary gave consideration to the fact that the plant was a going concern. The Court held that the evidence did not warrant it in holding the Secretary's order to be confiscatory because there was no separate allowance made for this claimed element of value. The Secretary also excluded the value of certain property from the rate base on the ground that the property was not used and useful for stockyard purposes. That property included a livestock-show building and grounds and trackage adjoining loading and unloading facilities. The Court held that the Secretary's finding with respect to used and useful property was sustained by the evidence.

Various Marketing Decisions

The first appellate court decision relating to the Tobacco Inspection Act was rendered on April 5, 1938, by the United States Circuit Court of Appeals for the Fourth Circuit (*Wallace et al.* v. *Currin et al.*, 95 F. (2d) 856). The court held that the regulation of the auction sale of tobacco, as provided in the act, was within the power of the Federal Government under the commerce clause of the Constitution. The facts showed that a large percentage of the tobacco sold actually moved to destinations outside of the State immediately following sale. The court also held that there was no unlawful delegation of legislative power to the Secretary of Agriculture or to the growers, who participate in referenda with respect to whether the act shall be applicable to particular auction markets.

During the past year there was a thoroughgoing attempt to establish the constitutionality of the regulation of interstate commerce in milk, as provided in the Agricultural Marketing Agreement Act of 1937. In October 1937, some 30 bills of complaint were filed in the United States District Court for the District of Massachusetts in an effort to restrain violations of Milk Order No. 4, as amended, which regulates the handling of milk in the Greater Boston area.

On November 19, 1937, the district court ruled that the Agricultural Marketing Agreement Act of 1937 and Order No. 4, as amended, were valid and constitutional and issued temporary restraining orders as to each of the defendants. Practically all of the defendants obtained from Judge Bingham, of the United States Circuit Court of Appeals for the First Circuit, writs of supersedeas which commanded the payment of equalization and marketing service funds

into the registry of the district court, pending the determination of the appeal, and the payment of market administration moneys to the market administrator.

The circuit court of appeals subsequently rendered a per curiam decision ordering that the temporary mandatory injunctions continue in force until a final determination of the cases on their merits. It was ordered, however, that the moneys involved in the appeals be paid into the registry of the district court in a manner equivalent to that provided in the writs of supersedeas. As of the end of the fiscal year, more than $1,000,000 had been paid into the registry of the district court pursuant to the writs of supersedeas. Hearings before a master, appointed by the district court, on the application for a permanent injunction were concluded on April 28, 1938. These cases, the leading one of which bears the title *United States et al.* v. *H. P. Hood & Sons, Inc., et al.*, will undoubtedly furnish a basis for an authoritative adjudication by the Supreme Court as to the constitutionality of the program.

Twenty-eight Hour Law Ruling

A controversial point with respect to the 28-hour law (34 Stat. 607) was determined by the Supreme Court during the year. On March 22, 1933, the Government brought suit in the United States District Court for the Eastern District of Louisiana against the Illinois Central Railroad Co. to recover the penalty provided by the 28-hour law for knowingly and willfully confining certain cattle in a car during interstate transportation for a period longer than that permitted by the act.

The defendant admitted that it had confined the animals for the period alleged but denied that it had knowingly and willfully so confined them, saying that its failure to unload them in time was due to the neglect of its night general yardmaster to notify another employee, whose duty it was to unload them, that they would be delivered in the early hours of the morning. Thus, the issue was substantially whether the failure to unload animals in accordance with the statute, caused by the negligence of an employee, was a knowing and willful failure attributable to the carrier. This question frequently had engaged the attention of the courts, and the district courts and the circuit courts of appeals by which it had been considered were about evenly divided in their opinions.

The Supreme Court held that indifference, inadvertence, or negligence of employees cannot excuse overconfinements under the act (58 Sup. Ct. 533).

OUR CHANGING HIGHWAY NEEDS

Progress in the work of highway improvement administered by the Department brought to completion during the year projects of several classes involving the improvement of 17,513 miles of road.

The greater part of this work was carried on in cooperation with, and under the immediate supervision of the State highway departments. In this way, during the year, improvements were completed on 9,333 miles of the rural portion of the Federal-aid highway system, 2,037 miles of secondary or feeder roads, and 760 miles of roads and streets in municipalities. The lesser part of the work, done without substantial State cooperation, includes improvements in the national forests and parks, the reconstruction of flood-damaged roads and supervision of the construction of roads financed with funds allotted by the Public Works Administration and the Works Progress Administration. The mileage of roads improved during the year in such exclusively Federal projects aggregated 5,383. Work in the national forests was supervised both by the Bureau of Public Roads and the Forest Service. The other classes of work were supervised by the Bureau of Public Roads, acting in most instances, under interdepartmental agreements, as the engineering agency of other Federal agencies.

The secondary- and feeder-road program, financed by special appropriations which now must be matched by the States, serves to extend improvement to a considerable mileage of the more important farm-to-market roads.

The roads built in the national forests and parks, in the Indian reservations, and on western public lands, are essential to the development and care of Federal reservations. They are necessary also to permit traffic through such areas, and to give access to areas of great natural beauty.

The program for the elimination of hazards at railroad grade crossings, financed mainly with unmatched Federal funds, is progressing steadily. Such lifesaving improvements would seldom be possible without specific Federal appropriations. The railroads cannot contribute the large percentage of the cost required by the laws of nearly all States, when State and local funds are involved. With the Federal money it is possible to carry out long-planned and needed projects.

Continued work on the Federal-aid highway system, with matched Federal and State funds, is passing into a second important stage. When the first Federal funds were appropriated, the arteries of intercity and interstate travel were largely unimproved. Travel over them was difficult almost everywhere. It is now relatively easy and convenient. This is the result of a planned distribution of annually limited funds over the whole system. The improvement effected, though generally less than that which will be needed ultimately, suffices for immediate needs. When the need of further improvement on any section becomes evident, it is met to the greatest degree consistent with the early completion of a desirable minimum improvement of the system as a whole. This method of stage construction has raised the main roads more quickly to their present reasonably satisfactory state than any other method could have done.

With unimportant exceptions, all parts of the Nation's network of main highways have now been initially, if somewhat inadequately, improved. It has become possible to devote a large part of the current Federal and State appropriations to supplementary improvements of the less adequate sections.

Principal Future Requirements

Among the inadequately improved sections are some of the most heavily traveled links of the system. Most of them were improved with durable surfaces then considered of sufficiently high standard. Growth in the volume of traffic and the recent marked increase in the speed of motor vehicles have produced a need of further improvement. The main defects are insufficient surface width, excessive curvature, and restricted sight distance.

The first results from the increase both in the volume and in the speed of traffic and the other two mainly from the speedier movement, which it was impossible to foresee and which occurred despite prohibitory laws. Moreover, the increasing speed of traffic creates a need for more mileage of highways of limited access; in other words, for "freeways" with lateral access to them restricted to points widely separated, with all or practically all level crossings eliminated, both of other highways as well as of railways, and with complete separation of the lanes of opposing traffic by medial neutral strips.

The most widely needed improvements are curve reduction and the increase of sight distance. Such improvements are necessary on thousands of miles of the Federal-aid and State highway systems. The need of greater surface width is less general and of more complex origin. To stretch the improved mileage, it was necessary to restrict the surface width. Generally, it is the easily corrected consequence of the policy of stage construction. With the increase in traffic, the surface widths of initial improvements have become more ample, and the narrower surfaces of earlier improvements have been widened.

The construction of surfaces 14 feet wide was accepted as permissible formerly. Later, thousands of miles of the principal highways were improved with 16-foot surfaces, and more thousands of miles still later with surfaces 18 feet wide. While many new surfaces are being constructed 22 feet wide, a surfaced width of 24 feet will soon come to be generally recognized as a desirable standard for important two-lane highways; and this further increase can also be provided as rapidly as necessary without embarrassing expense.

Heavy expense for road widening does not arise until the volume of traffic increases so that it can no longer be safely and conveniently accommodated on a two-lane surface. Even then if the addition of a single lane will suffice, provision of the needed relief presents no very serious problem. The construction of three-lane pavements has been tried. Under most situations it has been found unsatisfactory, especially from the standpoint of safety.

Proper accommodation of a volume of traffic that exceeds the safe and convenient capacity of a two-lane pavement requires the provision of two additional lanes, a total of four. But the accident record of four-lane pavements, when built without a central division, already points conclusively to the necessity of dividing the opposing traffic lanes. This still further increases the cost of providing adequately for the heavier traffic flows.

Preliminary results of highway-planning surveys indicate that, in the entire United States, there is not a very large mileage of highways on which four or more traffic lanes are required for the reasonable accommodation of the present traffic. There are now more than 3,400 miles of such width, but on the greater portion of this mileage there is no provision for the physical separation of traffic that moves in opposite directions. The normal increase of traffic will add to the need for four-lane highways and a considerable portion of the existing undivided four-lane highways must be further improved so as to separate the opposing traffic lanes. The provision of facilities of this general class is far behind the need.

Two Lines of Direction

Our highway program should be directed along two principal lines: (1) The maintenance and needed improvement of the main highways; and (2) reasonable improvement of secondary and feeder roads and roads of other categories that directly contribute to a better use of rural land. The second class includes forest and park roads, as well as the so-called farm-to-market roads. Further improvement of such roads should be consistent with well-planned use of the neighboring land.

There is much that definitely needs to be done along each line. There is more that various interests demand. One-sided familiarity with the needs may conduce to unbalanced programs. Attempts to meet all demands may exceed the willingness of taxpayers to pay the bills. It is important to obtain knowledge of all actual needs, and to explore the limits of supportable road improvement. This is the purpose of highway-planning surveys that are now in progress in 46 States. The information gathered in these surveys covers the volume and character of traffic on all roads, and the actual present adequacy of the roads to carry it. Congress has asked the Department for a report on the feasibility and need of the construction of a system of special transcontinental highways, and the surveys will provide essential data.

Despite the defects of the main highways, their condition is seldom conducive to accidents, except when coupled with the erratic actions of risk-taking drivers. Careful drivers seldom come to grief solely by reason of the inadequacy of either roads or vehicles. The number of accidents and deaths can be materially lessened only by centering the attack on driving habits and the selection of drivers. Such an attack, to be fully effective, must not stop with education

and persuasion. It must employ more positive means of checking reckless use of the highways.

With the aid of traffic experts and law-enforcement officers, the Department has made a careful and detailed study of this problem. It has prepared recommendations which, if put into effect by the numerous agencies involved, should greatly reduce the number of accidents.

Uniform Traffic Laws Desirable

The Department believes a first requirement is the enactment of uniform State laws. One provision should prohibit the driving of a motor vehicle except by licensed drivers. Licenses should be issued only to applicants who can qualify in a searching examination.

Patrol forces should be expanded for the enforcement of traffic laws. Violators should be punished impartially. Mandatory revocation of the driving license should follow the more serious or repeated violations. Official and thorough inspection of vehicles should rid the roads of old and unfit vehicles. Other steps should include the skilled investigation of traffic accidents, the establishment of a uniform system of compulsory accident reporting, a national program of safety education, and a highway-improvement program designed to eliminate dangerous conditions as rapidly as possible.

Henry A. Wallace,
Secretary of Agriculture.

Ag 84, 1937/38

AGRICULTURAL ADJUSTMENT 1937–38

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A Report of the Activities Carried on by the Agricultural Adjustment Administration

Under the Provisions of the Agricultural Adjustment Act of 1938, the Soil Conservation and Domestic Allotment Act, the Marketing Agreement Act of 1937, the Sugar Act of 1937, and Related Legislation, from January 1, 1937, through June 30, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL ADJUSTMENT ADMINISTRATION

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LETTER OF TRANSMITTAL

UNITED STATES DEPARTMENT OF AGRICULTURE,
AGRICULTURAL ADJUSTMENT ADMINISTRATION,
Washington, D. C., November 26, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: Herewith is transmitted the fifth report of the farm programs that have been carried on for the benefit of agriculture and in the public interest through the Agricultural Adjustment Acts, the Soil Conservation and Domestic Allotment Act, the Marketing Agreement Act of 1937, the Sugar Act of 1937, and related legislation.

An especial effort has been made to prepare a report sufficiently comprehensive and objective to be of the greatest value to yourself as Secretary of Agriculture, to Members of the Congress, and to others of the general public who are particularly interested in present and future problems of American agriculture. For their valuable help toward this end, particular credit is due to Harold B. Rowe, of Brookings Institution, who during a temporary appointment to the Agricultural Adjustment Administration outlined and assembled the economic analyses on which many of the conclusions of the report are based, and to Alfred D. Stedman, Assistant Administrator, who helped in shaping and editing the entire report.

The report is submitted with a recommendation that it be printed.

Sincerely yours,

H. R. Tolley

Administrator.

CONTENTS

Page

CHAPTER 1. THE BACKGROUND OF AGRICULTURAL ADJUSTMENT 1

I. Evidences of the Need for Agricultural Adjustment 1

Rural incomes low in comparison with city incomes—Large soil losses brought about by attempts to achieve greater cash income—Granger and Populist movements reflect agricultural maladjustment.

II. Sources of Agricultural Disadvantage 2

Irregular supplies conflict with inelastic domestic demand—Adjustment required by decline in foreign demand—Industrial tariffs shift excessive burden on agriculture.

III. Early Measures of Agricultural Assistance 4

Free-land policies were first aid to agriculture—Aid in improvement of crops, livestock, and soils marked post-Civil War period—Turn of century brings protection against unfair trade practices—Antitrust legislation seeks to enforce fair competition—Extension service brings advantages of research.

IV. Recognition of the Need for Adjustment 5

Need for greater agricultural credit recognized in Federal Reserve Act of 1913, Federal Farm Loan Act of 1916, and Federal Intermediate Credit Act of 1923—Need for group action recognized in farm cooperative movement—Need for better balance with industry recognized in search for farmers' tariff and for stabilized marketing.

CHAPTER 2. SUMMARY OF RECENT ADJUSTMENT LEGISLATION 11

I. The Agricultural Adjustment Act of 1933 11

Acreage or production adjustments provided through agreements or other voluntary measures—Funds provided through excise tax on processing—Act broadened in 1934—Act qualified as a result of Supreme Court decision in 1935—Processing-tax collections terminated by Supreme Court decision early in 1936.

II. The Soil Conservation and Domestic Allotment Act 15

Emphasis shifted from production adjustment to conservation of soil resources—Payments authorized for adjustment in land and farming practices—Total payments limited to $500,000,000 annually.

III. The Sugar Act of 1937 16

Act provides for regulation of sugar marketings through imposition of quotas—Payments conditioned on observance of labor standards—Excise tax placed on manufacture and importation of sugar.

IV. The Marketing Agreement Act of 1937 16

Act provides for marketing programs based on agreements and orders—Orders limited to specified commodities and products.

V. The Agricultural Adjustment Act of 1938 17

New act provides basis for an all-weather ever-normal granary program—Surplus control substituted for production or acreage control—Soil Conservation and Domestic Allotment Act significantly amended—Acreage allotments authorized for certain crops—Storage provisions make loans available on agricultural commodities—Marketing quotas authorized for certain crops under specified conditions of surplus and after approval by two-thirds of producers voting in referendum—Four new regional laboratories authorized.

CHAPTER 2. SUMMARY OF RECENT ADJUSTMENT LEGISLATION—Continued. Page

VI. Legislation and National Policy ---- 21

Democratic nature of agricultural legislation apparent in insistence on voluntary adjustments based on actual needs of the people as a whole—Agricultural Adjustment Act of 1938 is neither new nor final.

CHAPTER 3. PROGRAMS OF THE AGRICULTURAL ADJUSTMENT ADMINISTRATION ---- 23

I. Commodity-Adjustment Programs, 1933–35 ---- 23

Producer contracts used to restrict production—Benefit payments served both to limit production and to increase farm income—Processing taxes set up difference between world and domestic prices and also provided funds—Supplemental features included commodity loans and marketing agreements.

II. Agricultural Conservation in 1936 ---- 30

Crops classified according to effects on soil—General soil-depleting base acreages established—Separate bases set up for certain commodities—Conservation payments made both for diversion from soil-depleting uses and for soil-building crops and practices—Program extremely adaptable to needs of various regions—Brief comparison with earlier adjustment procedure.

III. The 1937 Conservation Program ---- 33

Fundamental aims and mechanisms were the same as those in 1936 program—Changes are largely in direction of greater flexibility to meet new conditions—More emphasis is placed on soil-building practices—Deductions made from payments for failure to meet minimum conservation objectives—Crops classified as soil-depleting, soil-conserving, or neutral—Soil-conserving and soil-depleting base acreages used—Farms classified as diversion and non-diversion farms—Crop acreage goals are used to determine desirable variations from past land uses—Three types of payments to producers are provided—Summary of results.

IV. The 1937 Range Conservation Program ---- 51

Program formulated after conferences with stockmen in all States with open ranges—Benefit payments made for range-conserving practices without regard to acreage bases—Range-building allowance based on grazing capacity of range land—Ten approved practices announced for Western Region—Practices modified to meet range conditions in other areas—Results of program summarized.

V. The Sugar Program Under the Sugar Act of 1937 ---- 54

New Sugar Act similar to earlier Jones-Costigan Act—Brief outline of provisions of act—Quotas based on consumption requirements—Payments conditioned on meeting certain standards set up for producers—Child labor forbidden—Fair and reasonable wages required to be paid to all employees engaged on the farm for sugar production—Farm marketings limited to proportionate shares—Program linked with soil-conservation program—Results of the program for first ten months summarized.

VI. Activities of the Consumers' Counsel Division ---- 61

Consumer activities in 1937 directed toward representing consumer interests in the farm program and toward distributing information—Various studies undertaken—Four main categories of consumer information listed—Consumers' Guide distributed biweekly—Advances in cost of living in 1937 limited almost entirely to nonfood items—Farmer's share of consumer's dollar increased for fifth consecutive year.

CHAPTER 3. PROGRAMS OF THE AGRICULTURAL ADJUSTMENT ADMINISTRATION—Continued. Page

VII. EXPERIMENTAL-COUNTY CONSERVATION PROGRAMS 67
Designated counties set up as program laboratories—Special programs designed to test alternative policies and procedures—Democratic aspects of conservation stressed more than in regional programs—Results of 1937 programs summarized—Experimental programs continued in 1938.

VIII. MARKETING AGREEMENTS, LICENSES, AND ORDERS 70
Immediate purpose of original agreements was improvement of returns to producers—Legal status of marketing agreement programs clarified by Marketing Agreement Act of 1937—Present programs for general crops designed to adjust supplies more nearly in line with market conditions—Programs for fluid milk hampered by uncertain legal status—Cattle disease eradication programs continued.

IX. PROGRAMS FOR SURPLUS REMOVAL AND EXPANSION OF MARKETS 82
Brief history of Federal Surplus Commodities Corporation—Purchases listed according to commodities—Purchasing methods explained — Offer - and - acceptance method innovated in 1938—Export programs and diversion programs bound by separate objectives—No exact formula used in determining payments to producers—Chief benefit to producers found in effect of surplus removal—Brief outline of programs carried out—Results extremely satisfactory in a number of programs.

X. NEW ACT AND NEW PROGRAM, 1938 97
The reasons for the new act—Accumulation of farm surpluses and rising unemployment create serious problem—General objectives of new act cited—Act amends Soil Conservation and Domestic Allotment Act—Additional provisions authorize systematic storage of food and feed surpluses, marketing quotas for certain crops under conditions of surplus, and crop insurance for wheat—Parity payments authorized for certain crops—Small producers given increased protection—Changes in 1938 program outlined—Outline of effect of new provisions on cotton, tobacco, corn, wheat, and rice—Loan provisions explained—Local administration by farmers emphasized.

CHAPTER 4. OBJECTIVES IN AGRICULTURAL ADJUSTMENT POLICY 123

I. EMERGENCY FACTORS DOMINATED EARLY OBJECTIVES 123
First programs launched in period of acute depression—Immediate objective was enhancement of farmer income and purchasing power—Processing tax funds supplemented farm income.

II. FIRST OBJECTIVES MODIFIED BY DROUGHT 125
Drought effected greater adjustments than those planned by A. A. A.—Benefit payments played important role in drought relief—Program modified to bring about controlled expansion of food and feed supplies greatly reduced by drought—Gigantic cattle-purchase program undertaken.

III. LONGER-TIME OBJECTIVES EMERGE 126
Permanent objectives persisted through emergency periods—Character of objectives foreshadowed in early outlook reports—Objectives fostered in local projects—Objectives repeatedly obscured by emergencies—Administrative thought eventually crystallized in direction of permanent program of production planned for benefit of both farmers and public at large.

IV. THE SIGNIFICANCE OF THE SOIL-CONSERVATION APPROACH 129
New approach involved less emphasis on restriction of production—Plan more flexible than the commodity approach—Emergency considerations recurred with drought—Principal immediate effects found in the reestablishment of farmers' incomes at more satisfactory levels.

CHAPTER 4. OBJECTIVES IN AGRICULTURAL ADJUSTMENT POLICY—Continued. Page

V. New Legislation Further Clarifies Objectives 131

Renewed emphasis placed upon control of total supplies—Cash payments authorized explicitly for supplementing farmers' incomes—New act introduced greater inflexibility in methods of attaining long-time adjustments, but emphasized giving farmers a larger place in formulation and administration of programs—Greater stability in supplies emphasized.

VI. Objectives in Marketing and Diversion Activities 133

From the beginning these activities played subordinate but important parts in the over-all program—National objectives never clearly defined—Procedure diversified through meeting each problem locally as it arose—Objectives likewise diversified—Principal immediate objective identical with that in the other programs.

VII. Continuing Objectives of the Program 134

Income adjustment established as one of the primary continuing objectives—Soil conservation and efficient farming ranked as of equal importance with income adjustment—Democratic planning and operation recognized as a permanent objective from the beginning and made apparent in recent legislation.

CHAPTER 5. EFFECTS OF THE ADJUSTMENT PROGRAM ON PRICES AND INCOME 139

I. Assumptions Underlying the Evaluations 139

Other conditions assumed to be the same with or without program—General recovery from depression assumed with or without any specific commodity program—Rise in general farm income and consumer income also assumed.

II. Conditions and Limitations of the Analyses 141

Study limited to cotton, wheat, corn-livestock, and tobacco—Unusual weather conditions make evaluation difficult—Estimates used are of gross income rather than net income—Indirect gains are not considered.

III. Corn and Livestock 143

Gain in income from meat animals estimated at $784,000,000—Total gain in corn-hogs estimated at $492,000,000—Effects of cattle and sheep purchase programs anaylzed.

IV. Wheat 147

Total gain in wheat income estimated at $293,000,000, exclusive of soil conservation payments—Benefit payments under early programs were largest factor in income gains.

V. Cotton 148

Appraisal difficult because of uncertain effects of program on foreign production—Estimated gain for entire 5 years placed at $876,000,000—Larger gains shown by alternative analysis.

VI. Tobacco 152

Four principal types of tobacco appraised—Total tobacco income gain set at nearly $416,000,000—Gains for specific types summarized.

VII. The Value of Appraisal 156

CHAPTER 6. ACCOMPLISHMENTS OF THE AGRICULTURAL ADJUSTMENT ADMINISTRATION TOWARD THE LONG-TIME OBJECTIVES OF SOIL CONSERVATION AND EFFICIENT FARMING 157

I. The Change From Waste to Conservation 157

Early abundance encouraged prodigality in use of soil resources—Experience of 20's showed necessity for united action—Individual and national interests must be reconciled.

II. The Variation in Regional Needs 160

Two principal types of action necessary—Erosion control highly important in the South—Shift out of intertilled crops recommended in many parts of the Corn Belt—Needs of other areas cited.

CHAPTER 6. ACCOMPLISHMENTS OF THE AGRICULTURAL ADJUSTMENT ADMINISTRATION, ETC.—Continued. Page

III. The Extent of Present Accomplishments 162

Effects have varied among years and among crops—Adjustments generally more significant under early adjustment programs than under soil conservation program—Drought was chief factor in recent increases in wheat acreage—New seeding of soil-conserving crops is the most important of conservation practices—Deferred grazing is important in range program—Programs have increased efficiency of farm operation.

IV. Some Problems Ahead 169

Some problems involved in setting up acreage bases and making acreage allotments—Another problem to be found in payment only for additional practices—Increased efficiency of production likely to affect acreage adjustments—A final important problem is that of keeping the program flexible.

CHAPTER 7. THE EXPERIENCE IN MARKETING ADJUSTMENT 173

I. Encouragement of Domestic Consumption Through Purchases for Relief Distribution 173

Purchases serve at times as direct aid to producer's market—Other purchases supplement other marketing programs—Various purchase programs appraised as help to producer—Programs appraised as aid to consumer.

II. Diversion to Export and Noncompetitive Uses 181

Various exports and diversion programs appraised—Distinctions found necessary between occasional and permanent surpluses—Export programs limited by ability of foreign markets to absorb additional supplies.

III. Programs for General Crops 186

Four types of volume regulation used in marketing agreements, orders, and licenses—Volume regulation more successful for nonperishables than for perishables—Regulation of perishables best achieved through regulation of grades and sizes—Price-posting policies inadequate without volume regulation.

IV. The Marketing Program for the Dairy Industry 200

By the end of 1937, Federal programs for fluid milk covered 23 marketing areas—Prices to producers and incomes both increased through programs—Difficulties have arisen in prorating receipts among producers—Various market relationships analyzed.

CHAPTER 8. PROGRESS IN ADMINISTRATION 209

I. The Administrative Organization 210

Washington organization outlined—Field organization outlined—Relationships with other field services shown.

II. The Immediate Task of Administration 211

Legislation interpreted and policies determined—Plans of operation formulated—Farmers enlisted to support program—Operations in field supervised—Completed operations analyzed and studied.

III. The Long-Time Task of Administration 213

Immediate administrative task adjusted to long-time objectives—Functions of overhead organization discussed—Democratic planning and operation a distinct objective.

IV. Progress Toward Local Planning 218

Local data assembled and used in shaping local plans—County planning project inaugurated in 1935—Experimental counties established—Discussion groups held in cooperation with Agricultural Extension Service.

V. Progress Toward Local Operation 222

County offices viewed as the heart of A. A. A. administrative and educational system—Relationships between county agent and county committees discussed—Committees are most effective when given active help of able county agents.

CHAPTER 8. PROGRESS IN ADMINISTRATION—Continued. Page

VI. The Development of an Informational Policy 226

Information prepared for both the farmer and the general public—Existing press and radio services utilized—Research facilities kept available—Objectivity the aim in all general informational activities—Unbiased inquiry the background of all farm releases—Elements of persuasion used only after definite, best program has been decided upon—Democracy not endangered by persuasive nature of such information.

VII. What the Experience Has Shown 243

Considerable measure of success attained in progress toward immediate goals—Administration has been responsible, reasonably efficient and effective—Progress toward long-time objectives has been as rapid as could be expected—Democratic procedure the surest and safest even though less rapid in attaining its ends.

CHAPTER 9. CONCLUSION 247

I. The Program as an Aid to Recovery 247

The Agricultural Adjustment Administration program was a program of action when action was needed—Through the program farmers learned how to work together in defense against both depression and drought.

II. The Program as an Aid to Agricultural Conservation and Stability 248

Conservation of the Nation's soil resources continues as a primary responsibility—The program provides a cooperative means for meeting a grave national problem—The program has a responsibility to the consumer as well as to the farmer—Along with protection of the soil must go protection of the harvest—Because needs for the program are real, the program has emerged from all assaults stronger and better than ever.

APPENDIXES

Appendix A—Soil-Building Practices Approved as Means of Obtaining Class II or Soil-Building Payments, With Rates of Payment and Localities Where Approved:

Exhibit 1.—Approved soil-building practices, rates of payment earned by following such practices, and localities for which practices were approved under the 1937 Agricultural Conservation Program 251

Exhibit 2.—Schedule of soil-building practices approved under 1938 Agricultural Conservation Program 255

Appendix B—Data on Diversion and on Soil-Building Practices Carried Out Under the 1936 Agricultural Conservation Program:

Exhibit 3.—Diverted acreages with respect to which payments were made under the 1936 Agricultural Conservation Program, by States and regions 258

Exhibit 4.—Number of applications filed, acreage of cropland covered, total cropland acreage, and percentage of cropland covered, 1936 Agricultural Conservation Program, by States and regions 259

Exhibit 5.—Acreage of specified soil-building practices carried out under the 1936 Agricultural Conservation Program, by States and regions 260

Exhibit 6.—Acreage of terracing, listing, controlled summer fallowing, and miscellaneous practices carried out under the 1936 Agricultural Conservation Program, by States and regions 261

Exhibit 7.—Acreages on which specified fertilizers and lime were applied under the 1936 Agricultural Conservation Program, by States and regions 262

Exhibit 8.—Range-building practices carried out on livestock ranches participating in the 1936 Range Program in the Western Region of the United States, by States 263

Page

APPENDIX C—DATA ON DIVERSION AND ON SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1937 AGRICULTURAL CONSERVATION PROGRAM (Preliminary):

Exhibit 9.—Diverted acreages with respect to which payments were made under the 1937 Agricultural Conservation Program, by States and regions (Preliminary) 264

Exhibit 10.—Soil-building practices carried out under the 1937 Agricultural Conservation Program, by States and regions (Preliminary) 265

APPENDIX D—STATISTICS ON SURPLUS-REMOVAL OPERATIONS OF THE FEDERAL SURPLUS COMMODITIES CORPORATION:

Exhibit 11.—Purchases by the Federal Surplus Commodities Corporation, by States, commodities, and sources of funds, November 18, 1935–June 30, 1936 272

Exhibit 12.—Purchases by the Federal Surplus Commodities Corporation, by States, commodities, and sources of funds, July 1, 1936–June 30, 1937 277

Exhibit 13.—Purchases by the Federal Surplus Commodities Corporation, by States, commodities, and sources of funds, July 1, 1937, to May 6, 1938 283

APPENDIX E—DISBURSEMENTS, JANUARY 1, 1937, THROUGH JUNE 30, 1938, BY STATES, COMMODITIES, AND OBJECTIVES:

Exhibit 14.—Agricultural conservation payments January 1, 1937, through June 30, 1938 289

Exhibit 15.—Rental and benefit payments January 1, 1937, through June 30, 1938, by State and commodity 292

Exhibit 16.—Administration of Sugar Act of 1937, January 1, 1937, through June 30, 1938 294

Exhibit 17.—Payments for purchase and diversion of agricultural commodities January 1, 1937, through June 30, 1938 294

Exhibit 18.—Total expenditures, January 1, 1937, through June 30, 1938, by States 295

Exhibit 19.—General administrative expenses, January 1, 1937, through June 30, 1938 295

Exhibit 20.—Miscellaneous expenditures January 1, 1937, through June 30, 1938, by States 296

APPENDIX F—DATA ON PARTICIPATION AND ESTIMATED PAYMENTS EARNED, 1937 AGRICULTURAL CONSERVATION PROGRAM (Preliminary):

Exhibit 21.—Estimated payments earned by classes of payment and by crop classifications, 1937 Agricultural Conservation Program, by States and regions (preliminary) 297

Exhibit 22.—Data on participation and estimated total payments, 1937 Agricultural Conservation Program, by States, Territories, and regions (preliminary) 298

Exhibit 23.—Estimated number of payees receiving net payments falling within specified size-of-payment groups, 1937 Agricultural Conservation Program, by regions 301

Exhibit 24.—Data on participation and estimated payments to be earned on 1937–38 sugar beet and sugarcane crop, 1937 Sugar Program, by States and Territories (preliminary) 301

APPENDIX G—MARKETING PROGRAMS:

Exhibit 25.—Marketing agreements, licenses, and orders in effect as of June 30, 1938 302

APPENDIX H—MISCELLANEOUS:

Exhibit 26.—Annotated compilation of the Soil Conservation and Domestic Allotment Act, as amended, the Agricultural Adjustment Act of 1938, as amended, and acts relating thereto 302

Exhibit 27.—Annotated compilation of Agricultural Marketing Agreement Act of 1937 354

Exhibit 28.—President Roosevelt's message to Congress on sugar legislation 367

Exhibit 29.—The Sugar Act of 1937 368

INDEX 381

Agricultural Adjustment 1937–38

CHAPTER 1

THE BACKGROUND OF AGRICULTURAL ADJUSTMENT

In the years since the founding of the United States the country has changed from a nation of farmers to a nation in which only one-fourth of the population lives on farms. As late as 1870 more than half of the gainfully employed in the United States were in agriculture; by 1930 the proportion had fallen to a little over a fifth.

This change has been due to a variety of causes. There has been an expansion of commercial and distributive services as manufacturing and processing took precedence over cultivation of crops and extraction of natural resources from the earth. A division of labor has developed in which farmers concentrated on raising foodstuffs and fibers while city workers took over many of the other tasks formerly performed on self-sufficient farms. An increase has taken place in services of transportation, communication, and government which the existence of large urban areas made progressively necessary. Underlying all these has been the advance of technology and invention.

I. EVIDENCES OF THE NEED FOR AGRICULTURAL ADJUSTMENT

This general transition from an agricultural to an industrial nation is a normal development and does not in itself warrant national programs to assist agriculture. There are, however, a number of factors, some inherent in the present economic structure and some historical, which have operated to throw agriculture out of adjustment with the rest of the economy and to thrust upon it a disproportionate burden of readjustment. The inability of agriculture to make this readjustment as part of its normal operations is evidenced in many ways.

On either a total or per capita basis rural money incomes are low in comparison with urban money incomes. Although noncash income which farm families receive from such sources as products raised on the farm and the use of farmhouses lessens the discrepancy which appears in the cash-income figures, the difference between the taxable resources in rural and in urban areas is clearly indicated by marked contrasts between rural and urban educational standards and public health services. The difference in remaining incomes available for

family living is indicated by relatively smaller numbers of automobiles, radios, telephones, and household appliances in use among farm as contrasted with city families.

This lower level of rural as compared with urban income is traceable, in part, to the smaller proportion of farm population in the productive age group. The country districts support, during the years of dependency, large numbers of children who move to the city when they reach working age. At the other end of the scale, the country districts have more people over 65 than do the cities. Security, however, although on a standard of living lower than the city standard, is apparently greater on the farm than in the city. This is attested by the large-scale movement from industrial to rural areas during the depression.

Further evidence of the need for adjustment is to be found in the continuous loss of soil fertility and actual physical destruction of the soil itself. These soil losses are attributable partly to purely individualistic competition in the sale of soil fertility. To some extent, soil losses are also a natural result of unfortunate systems of land tenure, and large fixed charges contracted for during land booms. Soil destruction is due partly to the low level and instability of farm income which have frequently made it difficult or impossible to maintain soil resources.

Evidence of the unusual difficulties of agriculture is to be found also in the recurrent farmer movements. The weakened position of agriculture as compared to industry was apparent after the Civil War. The Granger movement of the 1870's with its demand for the regulation of the railroads and for antitrust legislation, and the Populist movement of the 1890's with its demand for currency reform, reflected the pressure on agriculture of systems of transportation, distribution, and credit dominated by the nonagricultural groups. The acute disadvantage of agriculture following the World War galvanized the agricultural group into new types of action. The cooperative movement was extended in an effort to give farmers some of the types of advantages enjoyed by industrialists through the device of the corporation. The farm organizations, new and old alike, became increasingly concerned with the collective aspects of agriculture's problems.

II. SOURCES OF AGRICULTURAL DISADVANTAGE

The factors which underlie the difficulties of agriculture and which have made it advisable to take steps for positive assistance to agriculture may be outlined as follows:

In the first place, production in many commodities tends to be highly irregular. This irregularity flows from such influences as the relative inelasticity of the demand for farm products and from the lack of organization of the farm business. The inelasticity of demand causes prices to be high in years of low production and low in years of large production. To the numerous small-unit producers in agriculture the market for their products appears almost infinitely elastic in the sense that production adjustment on the part of an individual producer cannot affect the prices he receives. As a result, farmers as a group tend to overexpand when prices are high. This is a particularly unfortunate tendency when the high prices are

merely the result of low yields and consequent short supplies. Farmers also as a group tend to be reluctant to reduce production when prices are low because of the necessity of meeting fixed charges. Furthermore, the small farmer, unlike the manufacturer, cannot reduce operating costs by discharging large groups of workers.

Another factor giving rise to problems of agricultural adjustment has been the decline in foreign outlets for farm products.

In the latter half of the nineteenth century agricultural exports were large and were a vital factor in the economic advance both of the United States and of western Europe. Exports of food and raw materials helped to industrialize Europe. These exports also enabled the United States to repay the large foreign debt which it had contracted in the period prior to the attainment of American industrial maturity.

The trend of agricultural exports turned definitely downward at the beginning of this century, but this decline was offset by the expansion of the domestic demand for agricultural products, and no serious problem of adjustment appeared. The World War, however, caused an enormous expansion of American agricultural exports which could not be maintained because of the temporary nature of the foreign demand, the rise of new policies of agricultural self-sufficiency abroad, and the new creditor position of the United States. The necessary adjustment to the new level of foreign demand has not yet been carried out.

A further source of agricultural disadvantage is to be found in the relations between agriculture and industry. Agriculture has for many years been handicapped by lack of protection equal to that afforded industry by the tariff. Since the time of Hamilton's Report on Manufactures great emphasis has been placed upon the benefits which would accrue to agriculture from the subsidization of industry. While agriculture undoubtedly derived early benefits from this protection policy, the later results have been largely of an opposite nature. Prices of manufactured goods have been high as compared to those of agricultural commodities, and transportation rates and middlemen's margins have been increased. The result has been that the prosperity created for industry has left agriculture a relatively unpromising field for enterprise. Not only has the pressure on the marginal farmers been severe, but also much of the best rural manpower has moved to the cities. Along with this protectionism has gone a feverish exploitation of mineral, timber, and soil resources. Even when the measures of agricultural assistance such as technical research, education, and credit are thrown into the balance, the one-sidedness of our protective policies is manifest. The net effect has been to shift an excessive burden of economic adjustment upon agriculture.

Moreover, with the rise of industry have come large-scale enterprises and combinations of enterprises. For the most part, the control of these units has become highly concentrated. This has resulted in the introduction of "administered price" policies and the conscious adjustment of production to effectuate these policies. Ability to adjust production arises not only from the centralization of economic authority, but also from the production organization of industry, which permits part-time operation or complete shut-down through

the simple expedient of discharging workers. The result of industrial price policies has been a comparative inflexibility of industrial prices as compared with agricultural prices.

III. EARLY MEASURES OF AGRICULTURAL ASSISTANCE

Up to the beginning of the post-war period it seemed that governmental assistance to agriculture in the United States had two broad objectives. These were: (1) Rapid exploitation of the natural resources of the country, and (2) facilitation of the competitive process on the theory that active and free competition between individuals would best serve the economic welfare of the Nation as a whole. Exploitation of natural resources was hastened by subsidies of various sorts, while the competitive ideal was pursued chiefly by trying to increase the productive efficiency of individuals on the one hand and to enforce competition in spheres where monopolistic influences were present on the other.

The land policies of the Federal Government were the first development in the relationships between government and agriculture. The Homestead Act of 1862, and its modification in 1864, permitted actual settlers who lived on the land and cultivated it to gain title to tracts up to 160 acres. There were numerous supplementary acts. The Timber Culture Act of 1873, for example, granted 160 acres of land to anyone who would plant a limited portion of them in trees and cultivate them for a period of years. The Desert Land Act of 1877 provided for the sale of large tracts at low prices to persons who would irrigate them. Paralleling this policy of stimulating the acquisition of agricultural land by cultivators was that of stimulating the construction of transcontinental railroads by means of lavish grants of land, and in some instances by subsidies in the form of gifts of Government bonds.

Along with its land policies, the Government lent its aid to the improvement of crops, livestock, and soils. This aspect was particularly important in the period 1862–87, which saw the creation within the Department of Agriculture of a Division of Chemistry (1862) and a Division of Entomology in the year following. In 1884 Congress created the Bureau of Animal Industry, and in 1887 it passed the Hatch Act which established the system of State experiment stations.

Other objectives and lines of development appeared in subsequent years. These intermingled and overlapped. From about the turn of the century to the post-war period, great emphasis was placed upon the protection of both farmers and the general public against unfair trade practices. The names of some of the more important laws indicate the nature of the efforts which were made. There were, for example, the Meat Inspection Act of 1890, the Animal Quarantine Act of 1901, the Grain Standards Act of 1901, the Insect Pest Act of 1905, the Food and Drugs Act of 1906, the Plant Quarantine Act of 1912, the Federal Warehouse Act of 1916, the Packers and Stockyards Act of 1921, and the Grain Futures Act of 1923.

Closely related to regulation designed to protect farmers and consumers against abuses arising in the marketing and processing of farm products were attempts to curb big business. This regulation was undertaken chiefly under the railroad and antitrust legislation which

stretched from the period of the Granger agitation to the World War. With respect to the railroads, the major pieces of legislation were the Interstate Commerce Act of 1887, the Hepburn Act of 1906, and the Mann-Elkins Act of 1910. The primary objective of these laws was to give the Federal Government effective control over rates. With respect to industry, the major laws were the Sherman Antitrust Act of 1890, the Clayton Antitrust Act of 1914, and the Federal Trade Commission Act of the same year. In general the aims of these laws were, first, to enforce competition, and second, to make this competition subject to certain minimum ethical standards.

Another important development has been the educational activities of the Federal Government. The first important step dates back to 1862, when professional training in agriculture was encouraged by the establishment of the land-grant colleges under the Morrill Act. The major educational effort, however, did not come until 1914, when the Smith-Lever Act established the extension service under which the technical advances made in the agricultural colleges, the experiment stations, and the research branches of the Department of Agriculture were carried out to the farm. In addition, the Smith-Hughes Act of 1917 provided Federal grants-in-aid to assist the States in developing programs of vocational education, including agricultural education.

Beginning in 1922 the Department of Agriculture moved beyond the point of bringing improved methods of production to the farm and began the dissemination of economic information which would enable individual farmers to make adjustments in the light of forecasts of prices of farm products. This outlook service began with the idea of recommending increases or decreases in the acreage of specific crops. But recommendations applicable to the country as a whole did not fit individual farming areas, and by about 1927 the forecasting of the prices of agricultural products became the major concern of the outlook committees. In 1931, however, the Department was prohibited from making price forecasts because of alleged bearish effects, particularly upon the price of cotton. At present, the outlook appraises the factors likely to affect the price of each commodity and usually indicates whether these factors weigh in the direction of higher or lower prices. Somewhat more definite statements are made with respect to the probable movement of the general consumer demand for farm products.

IV. RECOGNITION OF THE NEED FOR ADJUSTMENT

The earlier efforts here referred to have been continued by the Federal Government. It has carried forward most vigorously those designed to aid the individual in increasing the amount and improving the quality of his product and also those designed to place at his disposal economic information on the basis of which he can adjust his enterprise to market demand. But measures directed toward placing agriculture in a position comparable to that which industry has attained in the modern economy have become increasingly important, particularly in the post-war period.

Of particular importance since just before the World War have been the activities of the Federal Government with respect to agricultural credit. Here the broad objective has been to make credit

available to farmers at rates comparable to those secured by commercial and industrial borrowers and to establish institutions adapted to the peculiar credit needs of agriculture. The basic measures affecting agricultural credit were the Federal Reserve Act of 1913, the Federal Farm Loan Act of 1916, and the Federal Intermediate Credit Act of 1923. The Federal Reserve Act permitted member banks to rediscount certain agricultural paper and to make limited loans on farm real estate. The Federal Farm Loan Act established the system of 12 Federal land banks and also the private joint-stock land banks. This new structure greatly increased the availability of farm mortgage credit. The Intermediate Credit Act, an amendment to the Federal Farm Loan Act, established a system of 12 intermediate credit banks governed by the directors of the land banks. The function of these banks is to rediscount the paper of agricultural credit corporations, cattle loan banks, and State and national banks, provided that such paper rests on loans made to finance agricultural operations and matures within 3 years. In 1930 these banks were authorized to make loans to any financial institution presenting eligible agricultural paper.

There have been numerous other measures affecting agricultural credit, although many of these have been means of implementing large-scale measures of agricultural reform rather than means of improving the agricultural credit system as such. Since 1921 Congress has made special appropriations for crop and seed loans to farmers in distressed areas. Large sums have been made available through the operations of the Federal Farm Board (1929) and also through the Reconstruction Finance Corporation (1932). In 1933 agricultural credit activities of the Federal Government were coordinated under the Farm Credit Administration.

THE EFFORTS TOWARD COOPERATIVE ADJUSTMENT

The farm cooperative movement in the United States has been of long duration and has embraced a diversity of objectives which may be summarized under four broad categories. These are: (1) Reduction of wastes in the marketing system; (2) improvement of the product marketed, through standardized production, grading, and branding; (3) development of bargaining power by groups of farmers to offset that of buyers, particularly middlemen, and bring about higher prices for agricultural products; and (4) adjustment of production to demand. The first and second objectives looked toward an improvement of the existing competitive system, while the third and fourth looked toward a fundamental change in the competitive position of agriculture in relation to industry. These latter objectives became dominant following the drastic price declines of the post-war period.

Efforts to encourage the movement toward agricultural cooperation date from the Sherman Antitrust Act of 1890, when an attempt was made to introduce into the act a clause which exempted from its provisions agreements or combinations among farmers for the purpose of enhancing the prices of farm products. The Clayton Antitrust Act of 1914 contained a clause which declared that associations of agricultural producers without capital stock and not conducted for profit could not *ipso facto* be declared combinations in

restraint of trade. The legal position of the cooperatives was further strengthened by the Capper-Volstead Act of 1922, which specifically authorized the organization of farmer cooperatives provided they were for mutual benefit. They were not exempted from the antitrust laws, but prosecution was conditioned upon a finding by the Secretary of Agriculture that they unduly enhanced prices through the restraint of interstate commerce. Still further assistance was given to the cooperative movement in subsequent measures designed primarily to cope with the problem of the agricultural surplus.

THE SEARCH FOR A FARMERS' TARIFF

One of the long-standing grievances of agriculture has been the greater degree of protection accorded to industry by the tariff. Import duties ordinarily do not increase materially the domestic price of commodities which are sold in the world market, and this fact has limited greatly the usefulness of tariff to agriculture. Nevertheless, Congress raised the duties on many agricultural products in 1922 and again in 1930. Thus wheat, which was on the free list under the act of 1913, was subjected to an import duty of 30 cents a bushel in the act of 1922 and of 42 cents a bushel in the act of 1930, while a duty of 15 cents a bushel placed on corn in 1922 was raised to 25 cents in 1930. The ineffectiveness of these measures to help farmers in most years is well known.

The 1920's, moreover, found the American farmer with a productive plant geared to the abnormal demand of the war and immediate postwar years, and with high fixed charges inherited from the land booms of the same years. The business collapse of 1920 and the subsequent downward readjustment in foreign demand brought about a period of chronic low prices for export commodities. The drop in money incomes of farmers was not offset by a drop in the cost of goods which farmers purchased. A conviction grew that the root of the agricultural problem was the existence of an export surplus, in the sense of a supply in excess of domestic requirements which could not be disposed of in the world market except at unremunerative prices.

While many persons advocated a drastic contraction of agricultural output to meet the changed conditions an even more insistent demand arose in favor of schemes that would immediately raise prices and incomes without forcing such contraction. The price objective was to be a fair exchange value, the income objective a fair share of the national income. Between 1922 and 1929 appeared a group of closely related proposals: The equalization-fee plan, the export-debenture plan, and the domestic-allotment plan.

The equalization-fee plan was embodied in the original McNary-Haugen bill of 1924 and in the vetoed bills of 1927 and 1928. The precise method of operating the scheme varied considerably in the different bills. Essentially, it consisted of disposing of surpluses abroad at a loss which was to be absorbed by the farmers themselves through the collection from them of the so-called equalization fee. Because of the relative inelasticity of the demand for farm products in the domestic market, it was presumed that losses on sales abroad would be much more than offset by the enhanced prices received on that portion of the supply sold in the domestic market.

The export-debenture plan first received congressional consideration in the McKinley-Adkins bill of 1926. It received its greatest publicity in the Jones-Ketcham bill of 1928 following the vetoes of the McNary-Haugen bills. The schemes embodied in these bills were rather complex, but in effect they provided for the use of tariff revenue to pay export bounties on certain agricultural commodities: Wheat, corn, tobacco, cotton, hogs, and cattle. In the final bill the bounties on most commodities were made equal to one-half of their respective tariff rates. Congress did not enact this plan into law.

The domestic-allotment plan was proposed as an alternative to the export-debenture and equalization-fee plans. It was designed primarily to avoid the stimulus to expand production that some farm leaders thought was inherent in the other two plans, particularly the export debenture. The basic idea was to raise the price of the domestically consumed portion of each crop by the amount of its tariff duty, the surplus above domestic consumption requirements to be sold abroad at the prevailing world price. Farmers were to be given certificates permitting them to sell part of their crop (the domestic allotment) in the domestic market. These certificates or "rights" were to be sold to processors who would be required to have certificates equal to the total amount of any commodity which they proposed to sell in the domestic market. On production in excess of domestic allotments, farmers were to be given no certificates and were to receive only the world price. A modified plan, in which the transferable certificates were replaced by benefit payments which were to be paid on the domestic allotment out of the proceeds of a processing tax and which were contingent on limitation of output, was embodied in the Hope-Norbeck bills of 1932.

THE SEARCH FOR A MARKETING APPROACH

During the period 1929–32 the McNary-Haugen type of approach was not pressed by its sponsors in the face of the Federal Government sponsorship of a marketing approach. The Agricultural Marketing Act of 1929, which set up the Federal Farm Board, had as its broad objective the placing of agriculture on a basis of economic equality with other industries through the orderly production and marketing of farm products. The major provisions of the act dictated an attack in the marketing sector. The Federal Farm Board encouraged cooperatives to unify the process of agricultural marketing with the support of loans from a 500-million-dollar revolving fund in the hands of the Board. At the outset the Board apparently viewed the development of a system of cooperative marketing associations as its principal function.

But with the drastic decline of agricultural prices which began in the latter part of 1929 the Board shifted its emphasis to the stabilization of agricultural prices. This was attempted first by making loans to cooperatives to enable them to hold their products from the market, and later by the organization of stabilization corporations for wheat and cotton. These corporations not only purchased commodities directly in the market but also took over supplies held by the cooperatives. These corporations were originally intended to be creatures of the cooperatives themselves, but, although they were legally organized as cooperative-owned enterprises, the Farm Board

took over the actual financing and operation and assumed all the risks.

The Board lost heavily upon commodities held through the stabilization corporations and concluded that gains from holding could be realized only if production was held in line with marketings. This experience was very influential in making production control a feature of the Agricultural Adjustment Act of 1933.

With the deepening of the agricultural depression, and its final development into a major factor in the general economic collapse, all of the currents which had been flowing in the direction of the formation of a strong agricultural policy converged. The result was the enactment of the Agricultural Adjustment Act of 1933.

These different currents included the excessive swings in agricultural prices, exploitation and destruction of soil fertility as a result of unlimited competition at low price levels, losses of export markets, and disadvantages to agriculture resulting from increasing organization of industry through the growth of corporations.

Powerful impetus to the plan of action outlined in the Agricultural Adjustment Act was given by the experience of the Federal Farm Board. After the failure of its attempts to maintain farm prices and farm income without having any control over supply, the Farm Board itself concluded that organization of farmers to give them some degree of production control would be an essential part of any farm program that could have a real chance of lasting success.

As a result of the various needs and movements outlined in the foregoing pages and of the experiences of the Federal Farm Board, and of farmers' marketing cooperatives, in attempting to grapple with economic forces without any adequate legal mechanism, the Agricultural Adjustment Act was passed by Congress. It was one of the first acts in the special session which was called by President Roosevelt at the beginning of his administration and it was signed by the President on May 12, 1933.

CHAPTER 2

SUMMARY OF RECENT ADJUSTMENT LEGISLATION

Consideration of the various proposals for meeting the problems outlined in the preceding chapter was overshadowed early in 1933 by the immediate need for coping with the national economic emergency which had arisen. Consequently, the major farm legislation embodied in the Agricultural Adjustment Act, approved May 12, 1933, was designed first of all to deal with the Nation-wide agricultural emergency, and in this way help to meet the general economic crisis confronting the Nation.

The new Agricultural Adjustment Act sought to achieve its objective by directly bringing about an increase in farm buying power. This was to be done to the end not only that the farmers' economic plight might be relieved by an immediate increase in income but that urban industries as well might benefit by a subsequent increase in farm purchases of factory goods.

In adopting means to attain this end, Congress was undoubtedly strongly influenced by the results of the Federal Farm Board experiment, which indicated to its own members and others that a program of lifting prices unsupported by some form of production control could not be permanently successful. Production control, therefore, was the dominant feature of the first Agricultural Adjustment Act.

I. THE AGRICULTURAL ADJUSTMENT ACT OF 1933

Under the provisions of this act the Secretary of Agriculture was empowered to provide for a reduction of acreage, or a reduction in the production for market, or both, of any basic agricultural commodity through agreements with producers or by other voluntary methods.

To accomplish this the Secretary could make benefit payments to producers who reduced their acreage or production for market of basic commodities under agreements with the Secretary. He could also make payments on that part of the production of any basic commodity required for domestic consumption. The commodities designated as basic in the act were cotton, wheat, tobacco, field corn, hogs, rice, and milk and its products. Cotton producers who signed acreage-reduction contracts were given the option of purchasing from the Secretary an amount of cotton not in excess of their estimated reduction in production at the price at which the Secretary purchased cotton from other governmental agencies.

As another method of increasing farm purchasing power, the Secretary was authorized to enter into marketing agreements and to issue

licenses to processors, associations of producers, and others engaged in the handling of any agricultural commodity in interstate or foreign commerce. These licenses aimed at better returns to growers and the elimination of unfair trade practices or charges that tended to prevent the restoration of normal economic conditions in the marketing of such commodities.

The act was financed through (1) an appropriation of $100,000,000 and (2) an excise tax levied on the processing of any basic commodity on which benefit payments were to be made. The tax funds could be used for the expansion of markets and the removal of surplus agricultural products, as well as for benefit payments and administrative expenses.

THE BROADENING AMENDMENTS OF 1934

In 1934 a number of laws were passed modifying and broadening the scope of the original Agricultural Adjustment Act. In the amendments, particularly in those concerning sugar, and in supplementary statutes as to cotton and tobacco, the marketing approach to the adjustment problem again received considerable emphasis.

The Jones-Connally Cattle Act.—The first of the 1934 amendments was the Jones-Connally Cattle Act, approved April 7. This act (1) added cattle, peanuts, rye, flax, barley, and grain sorghums to the original list of basic commodities; (2) authorized an appropriation of $200,000,000 to provide for surplus reductions and production adjustments in the dairy- and beef-cattle industries and to support and balance the markets therefor; (3) authorized the appropriation of an additional $50,000,000 to be used for relief purchases of dairy and beef products and for the elimination of diseased dairy and beef cattle. Under this act the A. A. A. program for the elimination of cattle afflicted with tuberculosis, Bang's disease, and mastitis, and the 1934 Drought Emergency Livestock Purchase Program were begun.

The Bankhead Cotton Act.—The Bankhead Cotton Act, approved April 21, 1934, supplemented the original Agricultural Adjustment Act by adding to the voluntary acreage-reduction methods a control over the volume of cotton marketed. It imposed no actual limitation upon the growing of cotton but did provide for establishment of a national quota of cotton marketing and for apportionment of this national quota among individual farms. Ginning of cotton from a given farm in excess of the tax-exempt allotment made to that farm was subject to a tax. Proceeds from the tax were to be used in connection with the cotton-control program. The allotments of individual growers were smaller than the production of those growers had been during the base period fixed in the act.

The act was to remain in force for the crop year 1934–35, and 1935–36 as well, if the President found and declared that the economic emergency with respect to cotton continued and if two-thirds of the cotton producers approved by referendum. It was in force for these 2 years, but was repealed by the act of February 10, 1936, as amended March 2, 1936.

The Kerr Tobacco Act.—Similar in intent to the Bankhead Cotton Act was the Kerr Tobacco Act, approved June 28, 1934. It added to the voluntary acreage reduction method a control over the volume

of tobacco marketed. A tax was imposed upon the sale of all tobacco with respect to which the act was applicable. Tax-payment warrants for use in paying the tax were issued under authority of the act to producers who entered into tobacco production adjustment contracts covering the amount of tobacco they were permitted to market under such contracts; while noncontracting producers were required to pay in cash the amount of the tax. The act was applicable to all tobacco harvested in the crop year 1934–35, except Maryland tobacco, Virginia sun-cured tobacco, and cigar-leaf tobacco, and to all tobacco harvested in the crop year 1935–36, except Maryland tobacco, Puerto Rican tobacco, and cigar-wrapper tobacco. Its application to later crops had to be approved by a vote of tobacco producers.

The act also enabled the Secretary to set up cigar-leaf tobacco import quotas. It was repealed by the same Act of Congress which repealed the Bankhead Cotton Act.

The Jones-Costigan Sugar Act.—The Jones-Costigan Sugar Act, approved May 9, 1934, added sugar beets and sugarcane to the list of basic commodities covered by the Agricultural Adjustment Act. It authorized the establishment of annual marketing quotas for domestically produced sugar and for sugar imported into the United States. Processing taxes on sugarcane and sugar beets were authorized. As in the original Agricultural Adjustment Act, funds derived from this source were to be used for benefit payments to cooperating sugar beet and sugarcane farmers.

THE EMERGENCY APPROPRIATION ACT

With the onslaught of the 1934 drought the Emergency Appropriation Act was approved June 19, 1934. To meet the emergency and necessity for relief in stricken agricultural areas, to remain available until June 30, 1935, it provided $525,000,000 to supplement emergency funds and, in addition thereto, to extend aid to drought-stricken farmers. This act also made another $100,000,000 available to the Secretary to be used to pay off debts and protect the title to cotton acquired for distribution under the cotton-option contracts and for expenses incident to such transactions.

THE DEROUEN RICE ACT

Because rice growers were asking for a rice program based on processing tax and benefit-payment provisions, the DeRouen Rice Act was approved March 18, 1935, as an amendment to the Agricultural Adjustment Act. It provided for a processing tax of 1 cent per pound on rough rice; the elimination of floor-stocks tax on clean rice; and the issuance of tax-payment warrants to be used to pay the rough-rice tax on rice from the 1933 and 1934 crops which had been purchased in accordance with provisions of the rice-marketing agreements and licenses or which remained in the hands of growers.

THE QUALIFYING AMENDMENTS OF 1935

Following the Supreme Court decision on May 27, 1935, in the N. R. A.-Schechter Poultry Corporation case, the Agricultural Adjustment Act was amended with a view to insure its constitutionality

and to strengthen, clarify, and simplify the legislative bases of the adjustment program.

These revisions were accomplished by amendments in the form of a new act, approved August 24, 1935, which limited and defined the authority delegated to the Secretary of Agriculture. Throughout the act he was directed rather than authorized to investigate facts and to effectuate specified correctives if investigations revealed certain conditions. Formulas for calculating processing-tax rates were laid down. References to interstate commerce were redefined in terms of previous Supreme Court decisions. The use of marketing orders in place of licenses was prescribed and these orders were specifically limited in their application and terms.

Strengthening and clarifying provisions of the new law included a redefinition of parity, provisions for certain payments other than rental and benefits, and for control of competing imports that tended to jeopardize the farm program. New provisions relating to specific commodities were inserted. The life of the Bankhead Act was extended to cover the crop years 1936–37 and 1937–38, if two-thirds of the cotton producers voting favored it. The Kerr Tobacco Act was also extended to April 30, 1939, with the provision that growers must approve that extension. Adjustment programs and processing taxes on rye and barley were provided for, and the adjustment program in effect for sugar was extended through 1937.

Another important provision which was contained in section 32 of the act of 1935 was an appropriation of an amount equal to 30 percent of the customs receipts of the Government to encourage domestic consumption and export of major farm commodities. This was the basis for the surplus relief, surplus removal, and surplus diversion programs of the A. A. A. Following enactment of this provision the Federal Surplus Relief Corporation was reorganized as the Federal Surplus Commodities Corporation, which since that time has been an important instrumentality in carrying out these programs.

The Potato Act of 1935 was embodied in these amendments. It established quotas for commercial marketing of potatoes and imposed a sales tax upon potatoes marketed in excess of the allotted quota. Miscellaneous provisions of the amendments included: (1) Encouragement of producer-cooperative enterprises and their activities; (2) authorization for appropriation of additional funds for eliminating diseased cattle; and (3) a marketing-agreement program for anti-hog-cholera serum.

THE EFFECT OF THE HOOSAC MILLS DECISION

The decision of the Supreme Court in the Hoosac Mills case on January 6, 1936, invalidating the production-control provisions of the Agricultural Adjustment Act, necessitated immediate action by Congress to protect the country from the consequences of sudden stoppage of the farmers' adjustment programs. In addition to legislation to furnish substitutes for these programs, some legislating had to be done to clear away the wreckage left by the Hoosac Mills decision.

Congress adopted the act of February 10, 1936, which has already been mentioned, repealing the Kerr Tobacco Act, the Bankhead Cotton Act, and the Potato Act. In addition, the Supplemental Appro-

priation Act, fiscal year 1936, approved February 11, 1936, appropriated $296,185,000 to meet all the Government's obligations and commitments incurred as of January 6, 1936, under the provisions of the Agricultural Adjustment Act as amended.

This appropriation was necessitated by the Supreme Court's termination of processing-tax collections. The act also authorized the carrying out of the 1935 cotton price-adjustment payment plan, after provisions of the plan requiring the cooperation of producers in the abandoned 1936 production-control program were deleted. This same appropriation act also provided for limited payments to cotton ginners for additional expenses they had incurred in connection with administration of the Bankhead Cotton Act in 1935.

II. THE SOIL CONSERVATION AND DOMESTIC ALLOTMENT ACT

In order that farmers might not be left wholly defenseless without any program after the Hoosac Mills decision, Congress immediately began work on legislation to take the place of invalidated parts of the Agricultural Adjustment Act. Sections 7 to 17, inclusive, of the Soil Conservation and Domestic Allotment Act were enacted on February 29, 1936, within 8 weeks after the Hoosac Mills decision and became the chief basis for A. A. A. agricultural conservation programs.

On the basis of the new legislation, the Agricultural Adjustment Administration entered the second major phase of its activity. In this second phase, emphasis still was placed on the problem of increasing agricultural income but the increase was sought primarily through payments for the adoption of land uses and farm practices which would conserve and build up soil fertility instead of through the adjustment of production or marketing.

Payments or other grants of aid were authorized to farmers who cooperated in a voluntary adjustment of their land and farming practices in line with the act's declared policy of soil conservation. The payments were to be based on the farmer's treatment or use of his land, the extent of adjustment required, or on the domestically consumed portion of his normal production of certain commodities, or a combination of these factors. Payments also were to be based on the productivity of the land on which soil conservation practices were adopted. The Federal obligations incurred by such payments were limited to $500,000,000 annually.

The act provided that Federal payments should be made directly to producers only until such a time as effective State agencies for accomplishing the purposes of the act had been set up, or until January 1, 1938. An amendment enacted on June 28, 1937, authorized direct Federal aid until January 1, 1942.

An additional section of the act of February 29, 1936, changed one of the purposes of expenditure of section 32 funds by making them available for making domestic allotment payments instead of for financing production-adjustment as originally provided. Other sections made the unexpended balances of the funds appropriated for the purchase of cattle and other agricultural products and for the elimination of diseased cattle under the Jones-Connally Act available for such purposes until June 30, 1937, and made the sum

of $2,000,000 of the unobligated balance of the appropriation for relief purposes contained in the Emergency Relief Appropriation Act of 1935 available for wind-erosion control in the southern Great Plains area.

III. THE SUGAR ACT OF 1937

To carry on the sugar program after the Hoosac Mills decision, a congressional resolution was approved June 19, 1936, continuing in force the quota provisions of the Jones-Costigan Sugar Act until December 31, 1937. The resolution further provided for the discontinuance of the processing tax and contract provisions of that act. This earlier sugar legislation was repealed by the more comprehensive Sugar Act of 1937, approved September 1, 1937, which is now in effect. This act provides for the regulation of sugar marketings in interstate and foreign commerce by the imposition of quotas on the continental United States, the off-shore possessions, and foreign countries, much as was done under the Jones-Costigan Sugar Act.

Consumers are protected against excessive prices by a provision authorizing the Secretary to adjust his estimate of consumption requirements, which forms the basis of the quotas, so that under ordinary circumstances the total supply of sugar made available will not be less than necessary to give consumers a per capita consumption equal to the average of the 2-year period 1935–36.

In order to adjust the marketings of sugarcane and sugar beets in the continental United States, Hawaii, and Puerto Rico to the sugar marketings permitted under the quota provisions, the act authorizes payments of 60 cents per 100 pounds of recoverable sugar to producers in those areas, provided their marketings are not in excess of a given quantity of sugarcane and sugar beets. The payments are also conditioned upon meeting certain standards with respect to child labor and wage rates, performing certain soil conservation practices prescribed by the Secretary, and, in the case of producers who are also processors, the payments of fair and reasonable prices for sugar beets and sugarcane. The act further provides for the levying of an excise tax of one-half cent per pound on the manufacture and importation of sugar, and the money obtained therefrom is paid directly into the general treasury.

To carry out the provisions of the act, an annual appropriation of not over $55,000,000 is authorized.

IV. THE MARKETING AGREEMENT ACT OF 1937

In order to clarify the legal status of the marketing programs, the validity of which was variously questioned following the invalidation of other sections of the Agricultural Adjustment Act of 1933 by the Hoosac Mills decision, the Agricultural Marketing Agreement Act of 1937 was approved June 3, 1937. The act provides for marketing programs which operate through marketing agreements or orders issued by the Secretary of Agriculture under specified conditions.

Under the provisions of the act the Secretary is authorized under certain market conditions to enter into marketing agreements with the producers, processors, and handlers of any agricultural commodity. He may issue orders, which are applicable to all handlers

of the commodity in question, only in the case of the following commodities and the products thereof (except products of naval stores and the products of honeybees) : Milk, fruits (including pecans and walnuts, but not including apples and not including fruits, other than olives, for canning), tobacco, vegetables (except vegetables for canning, other than asparagus), soybeans, honeybees, and naval stores.

V. THE AGRICULTURAL ADJUSTMENT ACT OF 1938

Sections 7 to 17 of the Soil Conservation and Domestic Allotment Act were recognized by Congress at the time of their enactment as providing only a partial basis for operation of essential farm programs. Many Members of Congress believed that basic new legislation would become necessary to protect agriculture from forces which were continuing in their effects. This belief gradually became more widespread, and in August 1937 Congress passed a joint resolution expressing its intention to make permanent agricultural legislation the first order of business when it reconvened.

The Agricultural Adjustment Act of 1938 was enacted on February 16, 1938. With this statute the administration entered the third phase of its adjustment activity.

In many respects this phase marks the adoption of a middle course between the programs authorized by the original Agricultural Adjustment Act of 1933, which covered the early phases of adjustment activity, and those authorized by the Soil Conservation and Domestic Allotment Act of 1936, which covered the second phase.

The adoption of this middle legislative course resulted from the fact that the adjustment value of the programs begun in 1933 was considerably obscured by the great droughts of 1934 and 1936, particularly since these droughts in themselves effected an acreage and marketing adjustment much more widespread than any planned under the programs. Hence, the net legislative effect of the drastic drought adjustment was to emphasize a belief that the permanent solution to the agricultural problem lay in a conservation approach rather than in an acreage or marketing approach. The inclination to regard this conservation approach as affording permanent results of more value than those offered by the other approach was probably very largely induced by the consequences of the unexpected invalidation early in 1936 of basic provisions of the original Agricultural Adjustment Act. This event, in any case, hastened the acceptance of this approach almost to the exclusion of all others in the Soil Conservation and Domestic Allotment Act, which was approved less than 2 months later.

AN ALL-WEATHER EVER-NORMAL-GRANARY PROGRAM

Unusually favorable growing conditions in 1937, however, and the prospect of excellent crop conditions in 1938 revealed the inadequacy of the conservation approach alone in a series of years of bumper crops. A broader program based on control of larger reserves through storage seemed distinctly advisable if the problems both of surplus and of drought were to be met. This realization is embodied clearly in the Ever-Normal-Granary idea, which served as the starting point for the 1938 legislation, and which sought to combine

in one permanent program the constitutional features of each of the earlier programs.

The background of the new Agricultural Adjustment Act of 1938 might be said to consist primarily of three factors. The first of these was drought, which in 1934 and again in 1936 showed the need of an Ever-Normal Granary of larger reserve supplies of wheat and corn for food and feed. The second was the record crop of 1937 and the prospect of another big crop in 1938, a situation which threatened to ruin farmers with surpluses again. The third was the Hoosac Mills decision, which invalidated production control as a means of protecting farm prices. The Agricultural Adjustment Act of 1938 sought to meet the first two of these conditions by providing for an Ever-Normal Granary to store up larger reserves as added protection against drought, and to meet the third by substituting surplus control, that is, control of marketings in interstate commerce, for the production-control approach of the original adjustment act.

The structure of the 1938 act itself serves to emphasize the compromise which it effects between the early and intermediate legislation. The early sections of the act are a legislative strengthening and continuation of the conservation programs carried out under the Soil Conservation and Domestic Allotment Act, and the later sections set up marketing and storage provisions for control of surpluses. The new features of the act lie in the Ever-Normal Granary plan embodied in the provisions for encouraging commodity storage under certain market conditions and for beginning a Federal crop insurance program for wheat.

THE AMENDMENTS TO THE SOIL CONSERVATION AND DOMESTIC ALLOTMENT ACT

The amendment specifying the mode of selection of local and county committees provides legal authority to use administrative procedure very similar to that which was already being followed as a result of the broad provision for utilization of local committees contained in the original act. The amendment requires the selection in a democratic manner of farmer committees, both community and county, to aid in the local administration of the programs. It specifies the appointment by the Secretary of Agriculture of State committees of from three to five resident farmers. The State director of the agricultural extension service is an ex officio member of the State committee, and the county agricultural extension agent is an ex officio member of the county committee.

The basis originally specified for determining payments to farmers was broadened by the inclusion of "their equitable share, as determined by the Secretary, of the national production of any commodity or commodities required for domestic consumption and exports." This represented a legislative change to an acreage allotment approach in place of the base-acreage approach of the earlier programs. It was a change that had already been begun administratively in the 1938 program. Methods of determination and apportionment of the national acreage allotments of certain crops are specified in the act.

Other amendments serve to give further assistance to tenants and to farmers receiving small payments. Tenants are safeguarded against lease changes which would increase a landlord's share of the

payments; and they are assured a division of payments between landlord and tenant in proportion as each shares in the crops or, in the case of payments for practices, as each contributes toward carrying out the practices.

Payments amounting to less than $200 are scaled upward according to a specified schedule. And, as a limitation to large payments, beginning in 1939 all individual payments are limited to $10.000.

A further amendment known generally as the McNary-Boileau amendment seeks to provide protection to dairy, livestock, and poultry farmers by conditioning conservation payments upon the avoidance of undue competitive expansion in these fields by other agricultural producers as a result of changes in land use brought about by the program.

THE EVER-NORMAL-GRANARY AND ALLOTMENT PROVISIONS

Regulation of the movement in interstate commerce of basic farm commodities is the foundation of the all-weather approach to agricultural adjustment found in the Agricultural Adjustment Act of 1938. On that basis the act seeks to provide for a continuous, stable flow of the major farm products into the Nation's markets at prices fair to both producers and consumers. To attain this end, mechanisms for regulation of surpluses of commodities are authorized in the reserve storage provisions, and mechanisms for protecting commodity price levels are authorized in the provisions for loans on stored commodities and for regulation of marketing through marketing quotas under definite conditions and in time of actual existence of surplus emergencies.

The acreage allotment provisions require determinations by the Secretary of the acreages with average yields needed to produce quantities of each of four basic crops—cotton, corn, wheat, and rice—sufficient to meet domestic, export, and reserve needs. Following upon these determinations, acreages for each of these crops are required to be allotted to the various producing States, and thereafter apportioned among counties and among individual producers.

The bases for these apportionments vary with the commodities, but in general the basis for the State and county allotments is past acreage, while that for the individual farm must take into consideration tillable acreage, crop-rotation practices, type of soil, and topography. The acceptance or rejection of the allotment as a basis of production is entirely voluntary with the individual producer.

The storage provisions authorize the Commodity Credit Corporation, upon recommendation of the Secretary and with the approval of the President, to make loans available on agricultural commodities. Under certain conditions the Corporation is specifically directed to make loans available to producers of cotton, corn, and wheat, at rates determined by prescribed percentages of the parity price of the commodity. The purpose of such loans is to encourage storage in times of surplus by making storage under such circumstances at least as profitable as immediate marketing, with a likelihood of its being even more profitable.

Regulations for the marketing of surpluses of the five basic commodities listed in the act are contained in the marketing quota provisions. Under these provisions, quotas regulating the amounts of

a commodity which may be marketed without penalty during the marketing year are applicable when specified conditions of oversupply exist. Upon the finding by the Secretary that such conditions do exist, quotas are applicable, but they are not to be made effective unless approved by at least two-thirds of the affected producers voting in a referendum on the question. Thus, as in the case of the acreage allotments, the acceptance or rejection of marketing quotas is voluntary with producers; but whereas an acreage allotment may be rejected under any circumstances by an individual producer, a commodity marketing quota, once it has been accepted by the producers of the commodity as a group, applies equally to all individuals designated by the terms of the act, and quota violators are subject to a price penalty for their excess marketing.

The act provides for review of marketing quotas by committees of farmers, with appeal therefrom to the courts, if individual farmers are dissatisfied with their quotas.

Special provisions for wheat establish the Federal Crop Insurance Corporation to inaugurate a Federal insurance program for this commodity. Under this program the insurance is against losses in yield through unavoidable causes and provides either 50 percent or 75 percent coverage. Both insurance premiums and insurance indemnities are computed in terms of wheat rather than money, so that the insurance reserves provide in effect an additional storage granary to be filled in years of fair or high yields and drawn upon in years when yields are low.

OTHER PROVISIONS OF THE ACT

Among a number of other provisions in the act, the following are most important from the standpoint of furnishing further legislative background for the adjustment programs:

1. The act authorizes the Secretary of Agriculture to prosecute before the Interstate Commerce Commission any freight-rate cases affecting the transportation of farm products.

2. It authorizes the establishment and maintenance of four regional laboratories to develop new uses and markets for farm products, and authorizes not over $4,000,000 annually for this purpose.

3. It extends the time of operation of the Federal Surplus Commodities Corporation to June 30, 1942.

4. It requires commercial handlers of the five major commodities subject to marketing quotas to record and report such information as the Secretary of Agriculture requires in administering provisions of the act.

5. Beginning with the 1938–39 fiscal year, it requires division of funds for administering the act, the agricultural conservation programs under the Soil Conservation and Domestic Allotment Act, and the diversion and surplus removal programs, on the basis of 1 percent of the total appropriations for expenses in the District of Columbia and 2 percent for expenses in the States.

RECENT APPROPRIATION ACTS FOR ADJUSTMENT PROGRAMS

1. The act of August 25, 1937 (Public, No. 354), appropriated $130,000,000 of "section 32" funds for price-adjustment payments to

1937 cotton producers who cooperate in the 1938 Agricultural Conservation Program.

2. The Department of Agriculture Appropriation Act, approved June 16, 1938, for the fiscal year ending June 30, 1939, appropriated $500,000,000 for the 1938 Agricultural Conservation Program, and $48,000,000 for the year's operation of the program under the Sugar Act of 1937.

3. The Price Adjustment Act of 1938, approved June 21, 1938, appropriated $212,000,000 for parity payments to producers of wheat, cotton, corn (in the commercial corn-producing area), tobacco, and rice, who cooperate in the 1939 agricultural conservation program.

VI. LEGISLATION AND NATIONAL POLICY

This summary of recent legislation and the outline of earlier legislation given in the preceding chapter indicate the nature of the evolution which is taking place in national agricultural policy. The democratic nature of that evolution is evident not only in the legislative insistence that the adjustments be voluntary for the individual, but also in the increasing insistence that the nature and extent of the adjustments encouraged by the Government be determined more and more by the actual needs of the people as a whole.

It becomes evident, too, that the Agricultural Adjustment Act of 1938 is neither completely new nor definitely final; that it represents, rather, the present culmination of the years of struggle which led up to the Adjustment Act of 1933 and the 5 years of legislative, administrative, and judicial experience which have followed.

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CHAPTER 3

PROGRAMS OF THE AGRICULTURAL ADJUSTMENT ADMINISTRATION

The legislative provisions summarized in the preceding chapter have been administered through the various programs carried out by the Agricultural Adjustment Administration. For the period prior to 1937 these programs have been described in previous annual reports and need not be recounted in detail here. But in order to analyze current activities, appraise results, and interpret long-time aspects of the programs, it is important to understand the essentials of what has been done each year. Hence, before discussing in detail the operations since January 1, 1937, a brief review of previous activities is desirable.

For convenience, the principal production adjustment operations undertaken during 1933–35, while the original Agricultural Adjustment Act was in force, may be considered separately from the soil conservation operations of the more recent period.

I. COMMODITY-ADJUSTMENT PROGRAMS, 1933–35

The central feature of Agricultural Adjustment Administration activity before the Supreme Court decision in the Hoosac Mills case was a series of production control or adjustment programs. These were used by producers of the basic commodities listed in the act, other than cattle and dairy products, and by producers of flax, barley, and grain sorghums.

The same general approach was used in all these commodity-adjustment programs. It embodied a combination of three specific methods authorized by the original Agricultural Adjustment Act.

These methods were: (1) Voluntary contracts between the Secretary of Agriculture and participating farmers, (2) benefit payments to contracting producers, and (3) taxes upon first processing of the respective commodities for domestic consumption. The function of these devices, their principles of operation, and the manner in which they were used, explain the real nature of the commodity-adjustment programs.

PRODUCER CONTRACTS

The essential provisions of each plan as it applied to individual farmers who participated were covered in the terms of the contracts. These varied among the different commodities according to the circumstances at the time the plan was developed, such as: (1) The nature of the enterprise affected, (2) the situation of the commodity and the manner in which this was analyzed, (3) the character of the

information or experience which could be drawn upon, and (4) the views of producers concerned. But in each instance the contract provisions covered the points which characterized the adjustment procedure as a whole.

It should be remembered that the early programs dealt with surplus emergencies. Hence all the plans sought to limit, at some point, the total output of the commodity concerned. Each contract therefore obligated the participating producer to restrict or limit his acreage or production in return for benefit payments. It was considered fairest and otherwise most desirable that, for a given commodity, such limitation be substantially uniform in relation to the usual or normal operations of each producer.

Hence, the first point that had to be established was a standard scale of operations to be used as the basis for the agreement. For this reason each contract established a base acreage or production for the particular farm to which it was applied.

Typically, the scale of operation during some previous period selected as most representative, or least affected by abnormal conditions, was taken as the base. Commonly an average of 2 or more years was taken. For some commodities the contract signer was permitted to choose from among several alternative methods of establishing a base the one which he judged to be the most favorable for his farm. This minimized the chance that an individual would be penalized because of unusual conditions on his farm during the base period. It also introduced an element of flexibility thought desirable in adapting the plans to the various conditions on different farms. The range of options offered to growers for determining their bases varied considerably, however, among the different programs.

Each contract signer agreed to limit his acreage or production to a specified percentage of his base. This percentage was fixed each year by the Secretary of Agriculture within limits provided in the contract. An exception was the case of corn, in which the contract ran for only one season. In its effect upon crops, this procedure meant that each contracting producer agreed to make a stipulated reduction in plantings, from his base acreage. Whether or not this involved any reduction from his current planting depended, of course, upon the amount of that current planting and upon the size of the base established for his farm. The closer the base to the current planted acreage, the smaller the reduction involved.

The difference between his base acreage and the acreage which the contract allowed him to plant was considered to be the acreage taken or kept out of production of the particular crop involved. In order to prevent these acres from being used to produce commodities for which other programs were in effect, their use was usually confined to the growing of soil-improving crops or food and feed for home consumption. Because of the acute feed shortage caused by the droughts of 1934 and 1936, limitations under several plans were relaxed in 1934, 1935, and 1936, and farmers were encouraged to use these lands for production of emergency forage crops.

Contracting producers were restrained from making adjustments in production at the expense of their tenants. Although enforcement was naturally very difficult, the contracts commonly prohibited signers from reducing unnecessarily the number of their tenants or share croppers below the number they had in 1933.

The remaining principal provisions of the commodity contracts specified payments to be made for the particular farms—usually by stipulating the basis and rates upon which the payments were to be computed—and prescribed their distribution between landlord and tenant.

BENEFIT PAYMENTS

The payments distributed among farmers who signed contracts under the respective commodity plans performed a double function.

Since they were conditioned upon compliance with the terms of the contracts, these payments provided the means of obtaining participation and thus reducing surpluses, with the purpose of restoring an equitable balance between the price received for the products that were marketed and the price paid by farmers for the commodities they customarily purchased.

But they also were direct contributions to farmers' incomes. Distributing them only to producers participating in the programs was an effective means of controlling the distribution of benefits as between those who cooperated in the program and those who did not cooperate. They were regarded as the economic main spring of the program.

These payments were specified in a number of different ways in the different commodity contracts, and were designated by a variety of terms. In general, however, they may be classed in three important types: (1) Payments at so much per acre (usually adjusted for productivity); (2) payments at so much per unit of the contracting farmer's pro rata share in the domestically consumed portion of the national production of the crop; and (3) payments per unit of the volume permitted to be sold or marketed.

Payments of the first type were made under the cotton and corn plans, of the second type under the wheat plan, and of the third type under the plan for hogs.

Plans developed for the several types of tobacco included variants of all these types, and still other types were used under other plans. Of these minor forms perhaps the most significant were payments intended to bring the producers' returns from marketing up to an established minimum, such as the cotton "price-adjustment" payments of 1935.

Rates of payment.—Several factors entered into the determination of the rates of these payments. The relative importance of these factors varied greatly among the different commodity plans. Certain important considerations had to be taken into account, however, in determining the rates of payment under all plans.

The first consideration sought was that payments should be large enough to assure contracting producers a total return at least as large as they would have received if they had not participated. This was necessary in order to secure the amount of participation required to make the balancing of production effective. As a general principle the payments were proportioned to the value of the crop which might otherwise have been produced on the land ordinarily devoted to the crop, but at the same time payments (except with regard to some kinds of tobacco) were calculated independently of yields in the year in respect to which they were made, so that they provided a measure of relief in case of crop failure.

In general, also, the consideration of obtaining the maximum possible benefits for farmers entered into the determination of payments and of the basis upon which they were distributed. This was true particularly in the case of groups of farmers who had suffered the greatest reduction in income.

Finally, the amount of money available was a limiting factor in all cases. This amount was determined by estimates of proceeds to be obtained from processing taxes, plus any additional funds that Congress appropriated.

Time of payment.—Although all payments were conditioned upon producers' full compliance with the terms of their contracts, these payments were not withheld until such compliance could be certified. On the contrary, in order to bring about an immediate increase in farmers' purchasing power, the plans typically provided for paying a substantial part of the benefit payment as soon as possible after the contracts were approved. The remainder was paid after the producer's compliance with the terms of his contract had been checked. Some of the plans involved payments in more than two installments.

The original corn-hog plans recognized that Government payments constituted an important part of the benefit of the plan. In order to make these payments large enough to assure immediate relief in rural areas, rates of payments under the contracts for the first season were set so high that they called for the distribution, in the first year, of the expected proceeds of 2 years' processing taxes. Similarly the wheat plan provided for benefit payments in three seasons, although the plan was to adjust production in only two seasons.

PROCESSING TAXES

Financing of programs by a tax on the first domestic processing was an essential feature of the commodity-adjustment plans. Since this tax was accompanied by a system of export refunds it had the general effect of taxing only that part of the commodity which was used for domestic consumption. The legislation authorized the rate of the tax to be fixed at an amount equal to the difference between the current average farm price and the parity price. Compensating levies were applied to the importation of products, the processing of which would have been taxed domestically, and in a few instances the processing tax was supplemented by taxes upon competing commodities which were designed to prevent shifts to the use of such commodities. Proceeds of all of these taxes were appropriated in advance, and thus largely provided for a continuous financing of adjustment operations without equal appropriations.

The processing taxes performed an important function beyond that of financing payments. Since these taxes together with the export refunds actually laid a tax burden only upon that part of the commodity used for domestic consumption, their first effect on a commodity moving freely in international trade tended to be the effectuating of a difference between the price paid by foreign consumers and that paid by domestic consumers.

To the extent that the taxes actually had this effect they served to establish a relatively higher price to domestic consumers without restricting the flow of the product to export markets. Hence, from

the standpoint of consumers, they constituted an economic equivalent of a two-price arrangement such as was contemplated by both the McNary-Haugen bill and the original domestic-allotment proposal.

When applied to a commodity such as hogs, for which domestic demand was not inelastic and for which the volume of exports was restricted by foreign quotas and similar measures, the amount collected through the processing tax was not a net addition to the sum paid for the commodity by consumers. Therefore, given certain supply and demand conditions, the tax tended to reduce the market price to producers below what it would have been in the absence of the tax.

To the extent that this occurred, part of the returns which producers, both participants and nonparticipants, would have received from the marketing of their products was withheld from the sale price and transmitted to cooperating producers in the form of payments.

For cooperating producers the effect on price was more than offset by the benefit payments which they received. In the case of noncooperators, however, the amount of price taken out as a tax was not restored to them, although they did share in the benefit of the program to the extent that emergency conditions were averted, and market prices were improved.

SUPPLEMENTAL FEATURES

Although alike in employing the basic mechanism of voluntary contracts through which farmers agreed to limit their acreage or production in return for benefit payments made from the proceeds of processing taxes, the commodity-adjustment plans differed in the way they were applied. Some of the variations in details of operation reflected fundamental differences in principle.

In all cases the plans were designed to (1) provide producers with supplemental income in the form of Government payments to those who participated, and (2) increase or maintain farmers' returns from sales of their products by raising or supporting prices through the balancing of production with demands. But the emphasis upon these two types of benefits was not uniform among the various commodities.

For example, with respect to cotton and some types of tobacco the major emphasis was placed upon immediate limitation of output in order to prevent excessive new supplies from coming on the market, to facilitate the liquidation of stocks deemed to be excessive, and to restore producers' prices to more equitable levels.

Hence the cotton-adjustment plan attempted definite restriction of acreage and production in all three seasons, while the wheat plan involved more moderate limitations which farmers were asked to apply in only two seasons, although benefit payments were made in all three seasons.

In those plans which placed the greatest emphasis upon the distribution of benefit payments to supplement income directly, the restriction upon production amounted mainly to a check against excessive expansion in response to increased income. In the most extreme case of this kind, sugar beets, the limitation was placed so high as to permit, in fact, an actual and considerable expansion.

These variations in principle underlying the different plans account in part for the variation in the use of other devices to supplement the application of adjustment procedure to particular commodities.

An important auxiliary method applied to cotton and tobacco and designed to reinforce the voluntary contracts was that of levying substantial taxes upon marketing in excess of quotas. This method was added to the program by the Bankhead Cotton Act and the Kerr-Smith Tobacco Act.

Emergency pig- and sow-marketing program.—Another measure for obtaining immediate reduction of surplus was the emergency program in which growers marketed 6,000,000 pigs and 250,000 sows with Government aid in late 1933. As a result of this operation the number of hogs sold in the 1934–35 season, although very large because of the number of marketings forced by drought shortage of feed, was considerably reduced below what it otherwise would have been. The feed which would have been consumed by the 6,000,000 pigs and 250,000 sows in the winter of 1933–34 was largely conserved on farms where it was available to mitigate the acute shortage which resulted from the drought of 1934. As a byproduct of this undertaking 96,000,000 pounds of hog products were distributed through relief channels.

Commodity loans.—Government loans to farmers on the security of stored commodities constituted a very important help in maintaining farm prices during these first 3 years of A. A. A. operation. Such loans were made on cotton and corn in all three seasons, and, in a much smaller way, upon stored gum turpentine and rosin in 1935.

The loans were made only on commodities in connection with which adjustment or marketing-control plans were in operation during the period. In each year they were offered only to growers on their crops for that season, and were available only to participants in the adjustment plans. They were made at fixed rates, regardless of the borrower's location and the distance from terminal markets at which the collateral commodities were stored. The loan value established for collateral was uniform except for differentials specified for major differences in the commodities. In all cases interest was charged at 4 percent per annum, and the terms permitted the borrowers to pay off their loans and take back the collateral or surrender the collateral in full payment.

The rates of these loans at times exceeded the market price during the period when they were outstanding, as was the case with the loan on corn in 1933 and the loan on cotton in 1934. Since these loans imposed no liability for repayment beyond the value of the collateral, there was no incentive for borrowers to repay them unless they could sell the commodity for more than the amount of the loan. Hence, loans at or above the price at the farm tended to check the marketing of the commodity until this price reached the level of the loan value. The price was, in effect, supported at this level by the loan. Insofar as they had this result, the loans were thus a powerful aid in enhancing the price.

This was particularly important when the price-raising effect of surplus control could not otherwise be realized until a succeeding season. Under such conditions the loans enabled producers to re-

tain title to products which might otherwise have been sold. Thus the loans contributed to the immediate support of farm prices. At the same time they made it possible for producers rather than speculators to obtain benefit from price increases which otherwise would not have occurred until after the farmers had sold their products. For these reasons the loans on cotton and corn at times had an important effect in assisting in the maintenance of farm prices.

Marketing agreements.—Price-supporting marketing agreements were another and a different method by which grower prices were raised during the interval before supplies in the market reflected the effects of production adjustment.

Six such agreements covering the principal kinds of tobacco were negotiated with leading manufacturers. These agreements differed in details but were fundamentally alike in purpose and nature. Their provisions were limited to the fixing of minimum quotas which manufacturers would buy at prices equalling or exceeding an agreed-upon average. In effect they amounted to a series of price bargains with the processors, covering a major portion of the tobacco produced in 1933.

The purpose of these agreements was to raise growers' returns from this crop which otherwise would have been sold before production could be adjusted sufficiently to affect market supplies and prices significantly. Hence, they supplemented production adjustment in tobacco as the price-supporting loans did for cotton and corn. But they accomplished this purpose through arrangements for manufacturers to buy virtually the whole supply and thus clear the market. In a sense, therefore, their method of operation was opposite to that of the commodity loans designed to accomplish the same purpose by facilitating the withholding of supplies from market.

A seventh tobacco marketing agreement of a quite different type was developed for shade-grown, cigar-wrapper tobacco. Under this agreement, growers and handlers developed a plan for maintaining substantial regulation of the production and marketing of this product. This agreement has remained in force since it was first applied in 1933 and represents a unique, though minor, commodity undertaking within the A. A. A. program as a whole.

Marketing agreements were also used in other ways to supplement production adjustment for wheat, rice, and peanuts. Under the provisions of a marketing agreement the exportation of some 28,000,000 bushels of wheat from three Pacific Northwestern States was subsidized. These operations were financed by allocating for this purpose the proceeds of about 2 cents per bushel of the wheat-processing tax. The cost of this operation was approximately $6,500,000.

Under marketing agreements covering peanuts and rice, attempts were made to apply plans incorporating production-adjustment features, but not employing processing taxes, benefit payments, or producers' contracts. The rice agreements were superseded by a more typical production-adjustment program in the second year, and the same step was taken with respect to peanuts after they had been added to the list of basic commodities through the amendments of April 7, 1934.

Marketing agreements were also used extensively with respect to dairy products, which were included in the list of basic commodities

from the beginning. However, in this use they were not developed as supplements to the production-adjustment procedure, which has never been applied to the dairy industry. Along with drought-relief activities, various types of diversion operations, and marketing agreements for nonbasic commodities, they may be taken up most conveniently in another part of this report, where their development during the whole period prior to 1937 can be discussed.

II. AGRICULTURAL CONSERVATION IN 1936

With invalidation of the processing taxes and original production-adjustment procedure by the United States Supreme Court on January 6, 1936, the repeal by Congress of the Bankhead and Kerr-Smith Acts on February 10, 1936, and the enactment of sections 7 to 17 of the Soil Conservation and Domestic Allotment Act on February 29, 1936, the over-all program of the Agricultural Adjustment Administration underwent rapid changes. Whereas prior to the Supreme Court decision, adjustment of acreage and production had been the primary objective defined by law, and soil conservation and farm management had been byproducts, after the decision the latter became the primary function under law, with production adjustment as the byproduct. The new Soil Conservation and Domestic Allotment Act sought to encourage and promote the adoption of farming methods that would involve less rapid exploitation of soil resources, reduce erosion of soil, and use a smaller percentage of cropland in the production of the major soil-depleting crops.

The basic procedure which characterized the new soil-conservation approach was the payment of cash benefits to farmers to offset the cost of soil conservation practices. Whereas, in the past, farmers had been forced in times of low prices to engage in competition in the sale of their soil resources for small returns, the new plan enabled them to engage in cooperative conservation. The payments were made to those taking land out of soil-depleting crops, increasing their acreage of soil-building and soil-conserving crops, and following practices helping to check erosion and reduce the depletion of soil fertility.

The nature of the 1936 program need not be described in detail in this report because it was fully set forth in the preceding report and because the 1936 program was similar in many respects to the 1937 program which will be detailed in this report. However, the essential steps involved were: (1) Classifying crops as soil-depleting and soil-conserving, and designating the soil-building practices to be encouraged; (2) determining the usual or normal acreages upon which these different types of crops are grown as the standard by which to measure changes; and (3) establishing the conditions under which payments would be made, and the rates of these payments.

As was related in the preceding report, crops which permanently remove large amounts of plant food from the soil, or are tilled in rows or by other methods that expose the soil to severe erosion, were classified under the 1936 program as soil-depleting. These include all the major cash crops. Crops which protect the soil from erosion and which, growing or turned under as green manure, store up plant food in the soil were classified as soil-conserving or soil-building. These included the legumes, perennial grasses, and new plantings of

forest trees. Practices preventing soil erosion, such as terracing, contour plowing, and strip cropping, and stimulating the growth of soil-conserving crops by applying lime and superphosphate, were defined as soil-building practices. General soil-depleting base acreages were established for the farm, with separate bases for cotton, tobacco, rice, peanuts, flax, sugarcane for sugar, and sugar beets. Two types of payments were made: A class I payment for diversion of land from soil-conserving crops by applying lime and superphosphate, were decrops or adopting soil-building practices. The program was administered in Washington through six regional divisions—the Northeast, East Central, Southern, North Central, Western, and Insular Divisions, and locally through county agricultural conservation committees elected by the farmers.

The amount of the diversion from the general soil-depleting base for which the class I payment would be made was specified as not more than 15 percent of the number of acres in that base for the farm. The average rate of this payment for the county as a whole was $10 an acre for land diverted from the soil-depleting base, varying for individual farms above and below this average in proportion as the productivity of the cropland on the farm was above or below the national average.

As a minimum condition to qualify for the class I payment, it was required that the total acreage of soil-conserving crops and soil-building practices on the farm in 1936 be at least 20 percent of the soil-depleting base for that farm, or else be equal to the acreage on which class I payments could be obtained.

In no case was the farmer paid for shifting more than 15 percent of his general soil-depleting base, but payments were approved for larger shifts in the case of the seven crops for which special bases were established, and different rates of payment were applied for diversion from these bases. For cotton the payment was 5 cents a pound on the average yield of the acres diverted into soil-conserving or soil-building uses, and this payment was made for diversion up to a maximum of 35 percent of the base acreage. Similar special arrangements were made for computing payments for land shifted from the bases established for tobacco, peanuts, and rice, with different rates and maximum percentages.

Under the 1936 program the maximum amount of the class II payment on any farm could not exceed $1 for each acre of cropland used for soil-conserving crops in 1936. This limitation did not apply in any case where it would have limited the amount of the class II payment to less than $10 for the farm. This last provision made it possible for every farm to participate in the program and to qualify for a cash payment of at least $10.

As related in the preceding report, the 1936 program was worked out very rapidly and under great pressure. While it was an emergency program, it possessed some definite advantages. One was its flexibility in regard to the amount and kind of adjustment involved. Producers who could not economically divert acreage from soil-depleting uses could participate and qualify for class II payments on their soil-building acreages and practices. Moreover, except in the case of the seven crops for which special bases were established, the plan did not require an adjustment in any particular crop in order to qualify for class I payments. These were made for land diverted

from the general soil-depleting base and the participating farmer was free to apportion the base acreage among the various soil-depleting crops as he saw fit. Thus he had wide latitude for adapting the plan to his farm.

A second feature which aided in regional adaptation of the plan was the establishment of the special bases for certain crops. By setting up these bases, authorizing different amounts of diversion from them, and providing special rates of payment for this diversion, the plan was adapted to the special conditions of the crops in a larger degree than otherwise would have been possible.

Finally, separate provisions for classification of crops, designation of approved practices, and rates of class II payments, were formulated for each principal region. To some extent these provisions incorporated modifications applicable to different States.

Because the plan was thus made adaptable to major differences in farm conditions, the general conservation procedure was carried out through several distinct regional plans, all of which embodied the basic procedure and principles of operation which characterized the national plan. . The regions that were established for purposes of regional administration had the following geographical areas:

The Northeast Region—Connecticut, Massachusetts, Maine, New Jersey, New Hampshire, New York, Pennsylvania, Rhode Island, and Vermont.

The East Central Region—Delaware, Kentucky, Maryland, North Carolina, Tennessee, Virginia, and West Virginia.

The Southern Region—Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Oklahoma, South Carolina, and Texas.

The North Central Region—Illinois, Indiana, Iowa, Missouri, Michigan, Minnesota, Nebraska, Ohio, South Dakota, and Wisconsin.

The Western Region—Arizona, California, Colorado, Idaho, Kansas, Montana, Nevada, New Mexico, North Dakota, Oregon, Utah, Washington, and Wyoming.

The Insular Region—Alaska, Hawaii, and Puerto Rico.

COMPARISON WITH EARLIER ADJUSTMENT PROGRAMS

This brief review of the 1936 soil-conservation program is intended to make clear its relation to the earlier production-adjustment program. The adjustment and conservation programs were alike in that both sought to achieve immediate improvement in farming conditions. To attain this end, both used the method of making payments to farmers. Moreover, under both plans payments were conditioned upon farmers' making certain adjustments in acreage as compared to a base which was intended to approximate normal.

There were, however, obvious differences between the two approaches. The commodity-adjustment plan aimed at parity of price, while the conservation plan aimed at conservation of soil resources. Under the commodity-adjustment plans, payments were arranged through the negotiation of adjustment contracts with the individual producer. Under the conservation plan no contracts were employed. Instead, the rates of payment and the conditions under which they would be made were simply announced so that farmers could make application for payments for which they were eligible, and payments

were disbursed when it was established that the prescribed conditions had been satisfied.

There was another major difference between the two plans. Production adjustment involved the use of processing taxes, whereas payments and other expenses of the conservation plan were financed from the Federal Treasury without the levy of such taxes to supply the funds. A third point of difference was that under the commodity-adjustment programs a farmer might have two or more contracts, be participating in two or more commodity programs, and be a member of two or more separate associations, whereas under the conservation program he could work out a single plan for his farm and belong to only one county association. Finally, production adjustment applied only to the commodities designated as basic, whereas the soil-conservation plan, in contrast, applied to all farms and to all commodities.

Although both plans offered farmers cash payments for curtailing their acreage and production of these basic soil-depleting commodities, the conservation plan permitted the participating producer a greater latitude in determining the manner and the crop in which the reduction should be made. This made the plan more flexible in its adaptation to individual farm conditions, but at the same time made it largely incapable of securing predetermined adjustments in the total output of any particular commodity. Hence, there was no coordinated use of supplemental features to insure effectiveness under particular conditions as there was in the commodity plans of the preceding period.

The 1936 program was carried through in a year that was marked by the second of two great droughts. This drought affected agriculture profoundly, and it also greatly affected the program. The small crop of corn which at only a shade over 1,500,000,000 bushels was about 1,000,000,000 bushels less than average, and the third successive short crop of wheat raised prices of both. The effects of the drought obscured the losses of foreign markets which in time of normal weather would tend to pile up surpluses in this country, beat down prices, and reduce farm income. The drought hampered the purpose of the 1936 program to stimulate the production of soil-conserving and soil-building crops, because the dry weather made it difficult to establish new seedings of legumes, grass, and pasture. As has been said, the 1936 program had to be worked out and put into effect very rapidly. While carrying on this program, the Agricultural Adjustment Administration went to work on improvements and modifications that it hoped would provide a better program for 1937.

III. THE 1937 CONSERVATION PROGRAM

In an effort to get the program before the farmers soon enough to permit a general understanding of it among them, and consequently a wide participation in it, the 1937 Conservation Program was announced December 4, 1936.

The new conservation program sought to promote a balance between soil-depleting and soil-conserving uses of farm land which would reduce the rate of depletion of soil fertility and the exposure of the soil to destruction by erosion. It was also a balance that would

tend to bring supplies of farm goods into line with the effective demand for them, at prices fair to both producers and consumers.

The new 1937 program, moveover, sought to use more effectively than in 1936 the provisions of the Soil Conservation and Domestic Allotment Act. The 1937 program was built with the same economic mainspring as in 1936. Benefit payments were available to farmers cooperating in the program at rates which would offset for them the cost of soil conservation. These payments were made to farmers who, on their own farms, reduced the proportion of their cropland devoted to production of soil-depleting crops when such reduction was practicable and desirable, and who increased the proportion of their farmland devoted to soil-conserving and soil-building uses and practices. These payments were open to farmers who applied for them and who were able to show that they had fulfilled the conditions.

CHANGES AND DEVELOPMENTS IN 1937

Changes and developments were made in the 1937 program to give it greater flexibility and increased adaptability to new and changing conditions, national, regional, and on individual farms.

This increased adaptability was obtained in three ways: (1) By permitting greater latitude to individual farmers in choosing among measures they might adopt in cooperating in the program, (2) by widening the provisions of the program to apply to a greater range of conditions, and (3) by changing the emphasis among certain phases of the program.

Emphasis on flexibility.—Events in 1936 had intensified the need for flexibility. The drought had proved even more severe than that of 1934. Spreading over a great part of the agricultural area of the United States, it drastically reduced agricultural production. This drastic reduction was particularly of feed crops, thus throwing the entire livestock industry out of balance. Although relatively higher prices prevailed for some products and made possible a higher gross income for agriculture as a whole than that of 1935, the distribution of this income among regions and among individual farmers was greatly disturbed by the drought, and the effect on income of farmers in drought-affected areas was disastrous.

At the same time that the drought demonstrated the need for flexibility and adaptability in the soil-conservation program, it focused attention on some basic principles of the program. For one thing, individual farmers who were helpless to combat drought concluded that in an emergency of scarcity as well as one of surplus, cooperative effort with the help of governmental agencies had large advantages over the purely individualistic ideas of competitive farming that had been the basis of Government farm policy prior to 1933. Moreover the program helped to meet the drought emergency by encouraging the planting of relatively greater acreages of hay, forage, and emergency feed crops which suffered less from the effects of the drought and therefore yielded more feed for livestock than would have been obtained from the row crops that were displaced under the program.

Emphasis on practices.—Aside from the modifications suggested by the drought of 1396, other changes appeared desirable in the light of the experience of that year. It was evident, for example, that

more opportunity should be provided for participation by producers on farms and in areas where the purposes of the program could not be wholly or mainly accomplished by diverting cropland from the production of soil-depleting crops.

In the Northeastern States, in a part of the North Central Region principally given over to dairying, and in the western range areas, the proportionate acreages of soil-depleting crops are relatively small. Diversion from such crops may not be desirable and soil-conservation in such areas can be best stimulated by promoting other practices that protect and improve the soil, prevent erosion, and maintain established acreages of soil-conserving crops such as pasture, legumes, and hay. Conservation and more efficient utilization of water and of vegetation in the range area constitute effective means of conserving agricultural productivity in the range areas.

New provisions for encouraging the practices mentioned were therefore added to the 1937 program, and emphasis was placed on these practices by enlarging the opportunities for obtaining payments by adopting them.

Conservation on small farms required greater encouragement than had been given to it under the 1936 program, and therefore minimum rates were established for benefit payments on small farms.

Through these and other changes, the Agricultural Adjustment Administration sought to make the 1937 conservation program available to and effective on virtually every farm, regardless of its type or size.

Emphasis on full performance.—It was further sought to promote more definite and positive performance of conservation measures other than diversion of cropland from soil-depleting crops, and to establish means for measuring such performance.

For this reason the requirements of the program as to minimum conservation accomplishment, including the establishment and maintenance of soil-conserving crops and the adoption of soil-building practices, were strengthened. To the same end, provision was made for certain deductions from benefit payments in cases where the minimum conservation objectives had not been attained.

In 1937, plans for administering the program locally through associations and committees of farmers were carried forward. Community as well as county committees of farmers helped to carry on the program. Committeemen were elected from among their own numbers by farmers who became members of the 2,967 county agricultural conservation associations. Membership in such associations included all farmers concerned with farms for which work sheets or other documents in connection with the 1937 program were filed.

Administrative expenses of the county associations and county and local committeemen in carrying out the work placed under their direction in 1937 were met in all regions by deductions on a pro rata basis from the payments to participating farmers in the county concerned.

DIVERSION OF ACREAGE FROM SOIL-DEPLETING CROPS

Almost every farm in the United States is affected to greater or less degree by erosion, depletion of plant nutrients, or overgrazing. This condition is due in large part to the fact that too great a

proportion of cropland is used for the production of crops which while they may offer larger immediate cash returns to farmers than do other crops, at the same time exhaust soil fertility rapidly and expose soil to destruction through erosion by wind or water.

It is often to the short-run interest of the individual farm operator to obtain maximum immediate yields, even though the producing power of his land for the future is reduced or destroyed. Competition in production among farmers drives them to exploit their soil. The economic disparity which puts farmers at a disadvantage in exchanging their products for the products and services of a closely organized industry intensifies the struggle for volume production regardless of permanent cost. The result of such competition, purely individualistic in character, in the exploitation and sale of soil fertility is tremendous economic loss to the Nation. It is doubtful whether any other long-time social loss is so great as the loss caused by destructive exploitation of soil, the result of unlimited competition for short-time individual advantage in the "mining" of the land.

Soil erosion is widespread in the United States. It is estimated that through erosion more than 50,000,000 acres of cropland have been ruined for farming in the past 300 years, and that some 250,000,000 acres more have been damaged.

Not only water erosion but in some vast areas, such as the "Dust Bowl" of the Great Plains, wind erosion does tremendous damage as rich top soil is carried away in duststorms that blacken the sky hundreds and even thousands of miles away. Soil denuded of grass cover is most exposed to erosion by both wind and water.

Production of feed grains—such as corn, oats, barley, and grain sorghum—and the cash crops—such as cotton, tobacco, potatoes, peanuts for nuts, and wheat—hasten soil erosion unless preventive measures are taken. Furthermore, continuous production of these and similar crops reduces soil fertility rapidly, and tends to break down the normal soil structure so that yields are reduced.

Estimates obtained in the Regional Adjustment Project of 1935, in the County Planning Project of 1935–36, and from the Soil Conservation Service, indicate that a reduction of some 25,000,000 acres in the plantings of soil-depleting crops, as compared with the acreages prevailing before 1933, would be desirable in order to check the rapid and wasteful exploitation and destruction of productivity and of the soil itself.

Therefore the 1937 program provided for encouraging on individual farms the shifting of acreage from soil-depleting to soil-conserving crops and uses. The payments to farmers played a vital part in the plan. They were the implement which enabled the farmers to cooperate in a program for the common interests of themselves and the country. The payments made it possible for farmers who formerly had been driven by low prices and small income into feverish competition in the exploitation of soil, to cooperate. They made conservation of soil pay immediate as well as long-time returns. The payments identified the farmer's short-time and long-time interest. They identified individual and public interest, too.

In promoting this shift the Agricultural Adjustment Administration did not overlook the fact that the Nation requires supplies of the soil-depleting crops for consumption and, unless prices are so low as to mean waste of soil fertility, for export. This necessity was

emphasized at the time the program was being formulated, by the drastic reductions in crops that were caused by the drought of 1936. Furthermore, the Soil Conservation and Domestic Allotment Act upon which the program was based prohibited any provision likely to discourage production of food and fibers at a level below normal domestic human consumption during the period 1920–29, with necessary adjustment for changes in population, and other factors.

The diversion from soil-depleting crops that was sought was such diversion as might conserve the soil and at the same time tend to reduce the production of that portion of the soil-depleting crops which could not be sold either in this country or abroad, at "prices fair to both producers and consumers" according to the provisions of the act.

The procedure for carrying out the diversion phases of the 1937 conservation program involved:

1. Classifying crops according to their effect upon cropland, as soil-depleting, soil-conserving, or neutral.
2. Establishing normal scales of planting, or "base acreages," of soil-depleting and soil-conserving crops.
3. Determining the percentage of the soil-depleting base acreage which it would be desirable to divert.
4. Determining the rates and conditions on which payment would be made for such diversion.

In all these steps it was necessary to take into account geographical, climatic, and other differences among regions, and market and economic differences among commodities. Differences among farm organization and management methods in different regions and on individual farms also had to be considered carefully. For example, a crop may be highly soil-depleting when handled as it ordinarily is handled in one region, whereas it may be much less so, or even have a soil-conserving value, when handled as it ordinarily is in another region.

CLASSIFICATION OF CROPS

In general, row crops were considered to be soil-depleting if grain or forage was removed from the land. In addition, small-grain crops harvested for grain or hay fell into this classification, except in the case of small-grain hay harvested in areas where emergency forage was needed.

All legumes and grasses on plowable land as well as forest trees planted on cropland were classified as soil-conserving. In areas where double cropping is a common practice, provision was made for counting the same acreage as both soil-depleting and soil-conserving when a soil-conserving crop followed or was interplanted with a soil-depleting crop. The neutral classification of crop and land use was established in order to account for all the land on each farm. It included such acreages as orchards not falling in either of the other classifications, permanent pasture, idle and fallow land, and waste and wood land.

With minor variations among States and regions, the crop classifications under the 1937 program were as follows:

Soil-depleting crops.—Corn (field, sweet, and pop corn), cotton, tobacco, sugar beets, sugarcane, rice, wheat, oats, barley, rye, flax,

buckwheat, emmer, speltz. (Mixtures of wheat and the grains listed above were classified as soil conserving when used as green-manure or cover crops and as neutral when used as emergency forage crops.)

Grain sorghums, sweet sorghums, Sudan grass, millet. (Except that the sorghums, Sudan grass, and millet were classified as soil-conserving when used as green-manure or cover crops and as neutral when used as emergency forage.)

Field beans and field peas, truck and vegetable crops, hemp, broomcorn, mint, mangels and cowbeets, cultivated sunflowers, potatoes and sweetpotatoes, melons and strawberries, bulbs and flowers, soybeans harvested for seed for crushing.

Soil-conserving crops.—Perennial legumes—alfalfa, kudzu, sericea, and white clover; perennial grasses—bluegrass, Dallis, timothy, redtop, reed canary grass, orchard grass, Bermuda grass, carpet grass, bromegrass, crested wheat grass, slender wheat grass, western wheat grass, gramma grasses, buffalo grass, bluestem grasses, Keeleria, perennial ryegrass, meadow fescue. Biennial legumes—sweet, red, alsike, and mammoth clovers; annual sweet clover; lespedeza; crotolaria; green-manure crops; winter cover crops; forest trees, summer legumes—soybeans, velvet beans, field peas, and cowpeas (in the Southern and Eastern States).

Neutral crops.—Vineyards, tree fruits, small fruits, bush fruits, nut trees, nursery stock, and emergency forage crops.

CROP-ACREAGE BASES

Two general types of base acreages were established as measures of the normal scale of land uses, from which desirable adjustments were made by farmers cooperating in the 1937 program. These two types included soil-depleting crop acreage bases of various kinds, and a soil-conserving base. In addition, a total cropland acreage was calculated.

Soil-depleting crop acreage bases.—The soil-depleting bases included: (1) A general soil-depleting crop acreage base, and (2) special soil-depleting crop acreage bases for cotton, tobacco, peanuts, sugar beets, sugarcane for sugar, and rice.

The general base covered all soil-depleting crops other than those mentioned, and thus permitted producers a wide range of choice among soil-depleting crops to be planted on this base.

Base acreages for soil-depleting crops were, in general, established for individual farms in 1937 in the same manner as in 1936. That is, they consisted of the acreages of soil-depleting crops grown on the farm in 1935, plus acreages diverted from such crops in order to earn payments under the 1936 program. There were provisions for making necessary adjustments in these bases on the recommendations of local and county committeemen in order to bring them in line with the bases for similar farms in the same localities and to meet other requirements. Adjustments were made on the basis of acreages measured in 1936.

Soil-conserving base acreages.—For each participating farm in the diversion group there was established a soil-conserving base acreage as well as the appropriate soil-depleting bases. The purpose of the soil-conserving base acreage was to set up a minimum

standard for the acreage of soil-conserving crops to be grown. This standard was both a means of promoting a definite increase in such crops and of measuring that increase.

For diversion farms in the Northeast, East Central, and Southern Regions the soil-conserving base acreage was the acreage in soil-conserving crops normally grown on the farm, plus the acreage diverted from soil-depleting crops in order to obtain payment in 1937.

For diversion farms in the North Central and Western Regions the soil-conserving base acreage was the total acreage of cropland on the farm, less the sum of all soil-depleting bases established for it.

Total cropland bases were set up for all farms in order to make it possible to calculate the soil-conserving bases for farms in the North Central and Western Regions and to calculate, for nondiversion farms, the soil-building allowance for maximum amount of payments to be earned by practices other than diversion.

Intertilled crop acreage limit.—In order to maintain, in the Corn Belt proper, a suitable balance between acreage devoted to intertilled row crops and acreage devoted to small grains, a corn-acreage limit was established for diversion farms in the Corn Belt, and producers were required to keep their plantings of corn within these limits in order to earn the maximum diversion payments possible for their farms.

Corn-acreage limits for each farm were based on allotments for each county in the Corn Belt, established by the Agricultural Adjustment Administration and apportioned by the county committee among the producers in the county. The aggregate of the county corn-acreage allotments in 1937 was slightly below the total acreage of corn planted in the Corn Belt in 1936.

The corn-acreage limits were established for farms in the Corn Belt only. While soil-conservation objectives call for a reduction in the acreages of row crops, especially corn and cotton, feed production in the Southern and East Central Regions is usually below or only equal to the need for such crops on the farms where they are grown. Therefore, diversion in those areas can better be made from cotton than from corn. In the commercial corn-producing area, on the other hand, corn is the chief row crop and a downward adjustment from the 1928–32 level was desirable in the interest of soil conservation in that area.

The total corn acreage for the country as a whole, contemplated under the 1937 program, was about 94,137,000 acres as compared with 102,769,000 acres as the 1928–32 average. The proposed acreage, at average yields, would have produced about 2,300,000,000 bushels of corn—enough to supply normal feed requirements of the livestock on hand and to leave a reasonably large carry-over into 1938.

DIVERSION AND NONDIVERSION FARMS

In order to give opportunity for participation in the 1937 program by producers on farms and in areas where the general soil-depleting crops—chiefly food and feed crops—occupy a relatively small proportion of the land and where, therefore, diversion from these crops is impractical or undesirable, the program provided for grouping farms into "diversion" and "nondiversion" groups.

In the Northeast and North Central Regions, farms on which the general soil-depleting base acreage was less than 20 acres were grouped as diversion farms, and the others as nondiversion farms.

In the Western Region farms with general soil-depleting base acreages greater than both 20 acres and 20 percent of the total cropland on the farm (excluding orchards and vineyards) were grouped as diversion farms.

In the Southern and East Central Regions crops for which special soil-depleting base acreages were established are more commonly grown, and there is greater need for the general soil-depleting food and feed crops for consumption on the farm. In these regions, therefore, farms were grouped as diversion farms only when their normal production of these crops was greater than the home-consumption needs for them, and when the designation of diversion farm was approved by the county committee. Other farms in these regions were grouped as nondiversion farms.

Only on diversion farms could payments be obtained by diverting acreage from the production of the general soil-depleting crops. Producers on nondiversion farms in all regions were given opportunity to participate in the program by carrying out conservation practices other than diversion from the general soil-depleting base acreage, and their opportunity for this participation was wider than that offered to the producers on diversion farms. Furthermore, they were eligible to obtain payments for diversion of acreage from special crop bases that might be established for their farms.

CROP-ACREAGE GOALS

When soil-depleting crop acreage bases had been calculated as standards to indicate the extent of different past land uses, it was necessary to determine the desirable variations from those past uses, for the country as a whole and on individual farms. It was also necessary to set up means of measuring those variations.

Questions arose at once in setting up these measurements of variation. "What acreage can and should be retained in the production of soil-depleting crops? What acreage should be diverted from such production and put to soil-conserving crops and uses? What should the plantings be in the interest of protecting and preserving the productivity of the Nation's cropland?"

The next question was: "How many acres of soil-depleting crops should be maintained in order to supply the Nation's consumption need for these crops at fair prices, and such export outlets as are remunerative to farmers, and to maintain an adequate reserve as protection against crop shortages or failures?"

In order to adapt the program to solving these problems, soil-depleting crop-acreage goals were worked out for the Nation as a whole, and for individual farms in the case of some crops. These goals were the acreages that would yield the adequate supplies of soil-depleting crops that were desirable.

Rates and conditions of payment under the program were designed to give no inducement for reducing the production of needed soil-depleting crops below the acreage goals set up for those crops.

Equally essential to the program were standards for measuring definite increases, encouraged by the program, in soil-conserving

activities and accomplishments. Such standards were provided in the soil-conserving acreage goals set up for individual farms. Methods of payment required individual producers to accomplish these minimum soil-conserving goals in order to obtain the full payments possible for their farms.

In order to work out the soil-depleting acreage goals it was necessary to estimate how many farmers would take part in the diversion of acreage, and what part of the total production they would represent. The greater the number of farmers taking part, of course, the smaller diversion would be necessary in order to effect the desired adjustment in the national acreage. Differences in the economic and market situations of different crops had to be considered in working out these goals.

When the 1937 program was announced it was estimated that farmers operating 85 percent of the total cropland of the country would take part and that they might be expected to accomplish 85 percent of the total diversion and soil-conservation measures possible on this percentage of the cropland. This resulted in the estimate of 72.5 percent of the possible performance for the entire country.

This estimate was used in calculating the percentage of diversion from the soil-depleting acreage bases which would result in the planting of the soil-depleting crop acreage goals. It was also used in working out the budget allocations for the different phases of the program.

Soil-depleting crop acreage goals for the country as a whole included the acreage of such crops which it was expected noncooperators as well as cooperators would plant. For each crop for which a special acreage base had been established, and for the general soil-depleting crop list as well, a national acreage goal was set up and the percentage of the base acreages which would need to be diverted from the farms of cooperating producers, in order to hold the plantings within the goals, was established.

The diversion percentages differed for the various crops in accordance with the difference in their marketing situations, and in their soil-depleting effects. The program provided for payment for diversion of only the established percentage of the individual producer's base.

For the general soil-depleting crop acreage base this percentage was 15 percent; for the cotton base, 35 percent; for the peanut base, 15 percent; for the fire-cured, dark air-cured, and Georgia-Florida type 62 tobacco bases, 30 percent; for the Connecticut Valley types 51 and 52 tobacco bases, 15 percent; for the flue-cured, Burley, Maryland, and other types of tobacco bases, 25 percent.

Soil-depleting crop acreage.—Among the soil-depleting crops, special bases or limits were established for corn in the commercial area, cotton, tobacco, and peanuts grown for nuts. All other crops, including wheat, were grouped together in a general soil-depleting classification and an overall base was established for this group.

The average annual acreage of corn in the United States in the period 1928–32 was about 102,800,000 acres. The acreage harvested in 1936 was 93,020,000 acres. The corn acreage goal for 1937 under the conservation program was set at about 94,137,000 acres.

Because of the drought experience of 1936 and the relatively high price of corn during the marketing of the small 1936 crop, which

totaled only 1,529,327,000 bushels as compared with a 5-year average of more than 2,500,000,000 bushels, noncooperating farmers in 1937 planted increased acreages of corn and the total planted acreage for the country as a whole that year was 96,483,000 acres. The harvested acreage in 1937 was 93,810,000 acres, and the crop amounted to 2,664,995,000 bushels whereas it had been estimated, in calculating the corn acreage limits for the Corn Belt, that a crop of 2,300,000,000 bushels would meet feed requirements, and leave a substantial carry-over for 1938.

For cotton, a goal of about 32,750,000 acres was set up. This was equivalent to a reduction of about 27.5 percent from the base cotton acreages of all States except New Mexico, Arizona, and California, where it was expected that the acreages would be about the same as in 1936. The crop expected from the acreage goal was about 13,-500,000 bales, which would have added perhaps 500,000 bales to the world carry-over of American cotton.

Both goal and expected production were exceeded in 1937. A total of 34,471,000 acres was in cultivation on July 1, 1937, and the yield per acre, which averaged 266.9 pounds of lint cotton, was the highest on record. The result was a cotton crop of 18,946,000 bales. This record production occurred notwithstanding the fact that about 8,900,000 acres were diverted from the special base established for cotton under the provisions of the 1937 program.

Acreage goals for different types of tobacco took into account the variations in the supply and demand situations of those types. Goals for flue-cured, dark air-cured, and cigar types were about equal to or slightly higher than the acreages of these types which had prevailed in 1936. It was proposed to encourage an increase of about 20 to 30 percent in the Burley acreage, which had been abnormally low in 1936. Goals for fire-cured tobacco were about 20 percent lower than the 1936 acreage of this type and some decrease in the acreage of Maryland tobacco was also held desirable.

Acreage goals for all types of tobacco totaled 1,600,000 acres as compared with an annual average of 1,874,000 acres in the period 1928–32 and 1,472,000 acres in 1936. Diversion from tobacco acreage for payment under the 1937 program provisions totaled about 292,000 acres.

The acreage goal for peanuts was set at 1,400,000 acres, about the same as the 1936 plantings, and about 54,000 acres more than the 1928–32 average. Favorable price conditions for this crop were anticipated. Diversion for payment totaled about 110,000 acres.

An approximate acreage goal for general crops of about 141,531,000 acres was used for 1937. Actually, the acreage seeded to these crops over-ran the goal by about 25,000,000 acres, with almost all of the over-run accounted for by wheat.

The desirable wheat acreages for the areas producing different types of wheat used in arriving at the general crops goal aggregated about 56,000,000 harvested acres for this crop. With yields at the 1928–32 level the crop from this acreage would have totaled about 800,000,000 bushels. At the average yield for the period 1928–35 the crop would have been about 700,000,000 bushels. Added to the carry-over from 1936, such a wheat crop in 1937 would have met domestic requirements of $25,000,000 to 650,000,000 bushels and left 100,000,000 to 200,000,000 bushels for carry-over or export. Total acreage of all

wheat seeded for harvest in 1937 was nearly 81,000,000 acres, with a harvested acreage of 64,460,000 acres and production of 874,000,000 bushels.

Table 1 gives the goals and the actual acreage seeded, by crops, for 25 principal soil-depleting crops, on the basis of data available at the time this report was prepared.

TABLE 1. *Approximate acreage goals and actual acreage seeded for 1937 for 25 principal soil-depleting crops,*[1] *by crops*

[Figures in thousands of acres, i. e., 000 omitted]

Crop	1937 acreage goal	Actual acreage seeded	Crop	1937 acreage goal	Actual acreage seeded
Cotton	32,761	34,471	21 others	141,531	[3] 166,062
Corn	94,137	96,483			
Tobacco	1,600	[2] 1,732	Total	271,429	[3] 300,401
Peanuts	1,400	[2] 1,653			

[1] Cotton, corn, wheat, oats, barley, grain sorghums, tobacco, potatoes, peanuts for nuts, rye, buckwheat, flaxseed, rice, beans, soybeans and cowpeas grown alone, sweetpotatoes, sorgo and sugarcane for sirup, velvetbeans grown alone, sugar beets, broomcorn, hops, fruits, and commercial vegetables.
[2] Harvested acreage.
[3] Excludes fruits and commercial vegetables, figures for which are not available on this basis.

Soil-conserving acreage goals.—Most important among the active steps which can be taken in the United States as a whole to protect the soil from erosion by wind and water and maintain its fertility is the establishment and maintenance of the crops listed under the 1937 conservation program as "Soil conserving." These crops include grasses, legumes, cover crops, green-manure crops, and forest trees. Because of their close-growing habit they hold the soil and prevent it from being washed or blown away. If they are permitted to remain on the land or, in some cases, are plowed under, they add to the humus and plant nutrients in the topsoil.

To establish the desired balance between soil-depleting and soil-conserving crop acreages on the farm land of the country it is necessary not only to reduce the acreage of soil-depleting crops, but to make definite increases in the acreage devoted to soil-conserving crops and practices.

Standards for measuring this increase were provided for individual farms under the 1937 conservation program by establishing for each farm in most areas a soil-conserving acreage goal. These goals were fixed by local and county committeemen after consideration of such factors as the size of the farm, its topography, the lay of the land, and the extent of the erosion that had taken place.

Payments for achieving these goals on individual farms were provided, and also deductions from payments for failure to achieve the soil-conserving goals.

A national soil-conserving acreage about equal to the acreage in soil-conserving crops in 1929 was used as a starting point in working out the soil-conserving acreage goal. The 1929 acreage was increased by about the number of acres of increase suggested in the 1935–36 county planning project, with due regard to the diversion from soil-depleting crops necessary in order to achieve the soil-conserving goal.

The soil-conserving acreage goal for the country as a whole, as figured by this method, was 92,500,000 acres, an increase of approxi-

mately 18,000,000 acres over the 1929 level. It was anticipated that some of this acreage would have to consist of emergency hay or forage crops in the drought areas where a large proportion even of the drought-resistant, soil-conserving crops had been killed out by the unusually severe drought and where it was impossible to obtain, in 1937, an increase over the normal level.

Since a diversion of some 24,000,000 acres from soil-depleting crop acreage bases was contemplated under the soil-depleting acreage goals, there remained several million acres on which soil-protecting and soil-building practices other than the planting of soil-conserving crops would be carried on if maximum payments were obtained.

Table 2 gives, by regions, the harvested acreages of soil-conserving crops set up as a goal for 1937, together with the harvested acreages of such crops in 1929 and in 1936.

TABLE 2.—*Soil-conserving crop acreage goals for 1937, and harvested acreage of these crops in 1929 and 1936, by regions (including rotation pasture)*

[Figures in thousands of acres, i. e., 000 omitted]

Region	Harvested 1929	Harvested 1936	1937 goal
Northeast	10,959	10,925	11,000
East Central	9,369	9,925	11,000
North Central	37,132	32,775	44,500
Southern	4,790	8,375	11,000
Western	11,957	10,625	15,000
United States	74,207	72,625	92,500

PAYMENTS TO PRODUCERS

Three types of payments to producers were provided for under the 1937 program. "Soil-conserving" or "diversion" payments were made for changing the use of the land from soil-depleting to soil-conserving crops, up to the maximum percentage of diversion specified for the different crops.

"Soil-building" or "practice" payments were made for planting soil-conserving crops on cropland in 1937 or for carrying out soil-building practices on cropland, range, or pasture land. The maximum amount of the soil-building payment which might be earned on a given farm was called the "soil-building allowance" for the farm.

The third type of payment was based on the percentage of the normal national production of sugar and rice needed for domestic consumption. To obtain these payments producers of sugar or rice met certain specified conditions with respect to their acreages of soil-conserving crops or their rotation practices.

Diversion payments.—"Diversion payments" for diverting land from the production of soil-depleting crops for which special bases had been established were made on the basis of the normal yield from the diverted land, of the commodity from the production of which it was diverted.

Rates of payment for these special-base crop acreage diversions were as follows:

Cotton, 5.5 cents a pound.

Flue-cured, Burley, and Maryland tobacco, 5.5 cents a pound.

Fire-cured, and dark air-cured tobacco, 3.85 cents a pound.
Georgia-Florida type 62 tobacco, 6.6 cents a pound.
Connecticut Valley types 51 and 52 tobacco, 4.4 cents a pound.
Other kinds of tobacco, 3.3 cents a pound.
Peanuts, 1.375 cents a pound.

Payments for diversion from the general soil-depleting crop acreage base of the farm were at the rate of $6.60 an acre, adjusted according to the relative productivity of the land so diverted, as compared with the average productivity of all the land in farms in the United States.

Payments for increasing soil-conserving crop acreages.—It has been pointed out that in addition to the payments for diversion, payments were made for increases in the acreage of soil-conserving crops on the farm. Rates and conditions of these payments differed according to the variations in the farm-management practices of various areas.

On all farms in the North Central Region other than dry-land farms in South Dakota and Nebraska, there was a payment of $3.30 an acre for increasing the acreage of soil-conserving crops above the soil-conserving base. This rate of payment was adjusted among farms in accordance with variations from the average productivity of all farms in the United States. The number of acres on which this $3.30 payment could be earned could not exceed the number of acres diverted from the general soil-depleting base for the farm, with a limit of 15 percent of that base.

For farms in the Northeast, East Central, and Southern Regions, the payment of $6.60 an acre for diversion from the general soil-depleting base and the payment of $3.30 an acre for increasing the soil-conserving crop acreage were made as one payment at the rate of $9.90 for each acre diverted from the general soil-depleting base, with deductions at the rate of $3.30 an acre for failure to have the minimum acreage of soil-conserving crops on the farm.

Sugarcane for sugar and rice.—Payment was made with respect to any farm on which sugarcane for sugar was grown in 1937 on the acreage allotment for the farm at the rate of 13.75 cents per 100 pounds, raw value, of sugar commercially recoverable from the normal yield per acre provided there was a soil-conserving acreage on the farm equal to 30 percent of the sugarcane base. If the soil-conserving acreage for the farm was less than 30 percent of the sugarcane base, certain deductions were provided for.

Payment was made to a rice producer in 1937 at the rate of 22 cents per 100 pounds of his domestic consumption quota, provided that he planted between 85 to 100 percent of his rice base acreage and provided further that he had an acreage of soil-conserving crops on the rice land equal to 25 percent of his rice base acreage. If a producer planted less than 85 percent or more than 100 percent of his rice base acreage or if he did not have the 25 percent soil-conserving acreage, certain deductions were provided for.

Deductions from payments.—Deductions from payments were provided for in cases where producers failed to fulfill certain requirements toward accomplishing the purposes of the act.

If 1937 acreages of cotton, tobacco, peanuts, or general soil-depleting crops on any farm exceeded the bases established for these crops,

deductions were provided for at the per-acre rate of the corresponding diversion payments for the farm.

On the farms on which a corn acreage limit was established, a deduction at the per-acre rate of the general diversion payment for the farm was made for each acre by which the corn acreage exceeded the limit. At the same time, the general diversion payment rate on farms on which corn acreage limits were established and observed was increased 5 percent above the rate for farms on which such limits were not established.

On farms on which the 1937 acreage of soil-conserving crops was less than the minimum established for the farm, a $3.30 deduction for each acre of the deficiency was provided for.

Adjustments on account of participation.—Under the provisions of the 1937 program as announced December 4, 1936, rates of payments to producers as listed in that announcement were subject to adjustment according to the extent of participation by producers. Budget allocations for payments to producers, from funds expected to be appropriated by Congress for carrying out the Soil Conservation and Domestic Allotment Act, totalled $470,000,000.

Rates of payments were so calculated as to apply the $470,000,000 on this basis, but provision was made for adjusting the rates by as much as 10 percent, either upward or downward, if actual participation differed from the estimated participation. Such adjustment by regions was authorized.

Because of the factors that have already been noted, participation was less extensive than had been anticipated, and the rates were therefore adjusted upward 10 percent in all regions. The rates which have been given above include this 10 percent adjustment from those announced December 4, 1936.

Payments for soil-building practices.—In order to make the conservation program applicable to and effective on farms where conditions were such that neither diverting acreage from soil-depleting crops nor increasing acreage of soil-conserving crops would accomplish the maximum amount of conservation, class II or "soil-building" payments were provided in 1937 for adopting and carrying out soil-building practices other than diversion. The same principle had been followed in 1936 but it was broadened and given more emphasis in 1937.

The wider range of practices by which payments might be obtained permitted the participation of a greater number of small farmers, dairy farmers, fruit and vegetable producers, and western range operators, than had taken part in the 1936 program.

In 1937 approximately one-third of the amount of money budgeted for the payments to producers was allocated for soil-building payments instead of the one-fourth which had been so allocated in 1936. This made possible higher rates of payment for the adoption of these practices, and additional encouragement for the adoption of these practices.

Furthermore, the approval of a wide variety of soil-building practices increased the regional, State, and local adaptability of the program. Soil-building practices were approved as means of obtaining benefit payments only after they had been recommended by State, and in some cases county, committees familiar with the con-

ditions in their own areas and with the effectiveness of the practices which they recommended for adoption.

The procedure of county or State recommendations of soil-building practices and the rates of payment therefore resulted in limiting the areas and localities within which certain practices were approved. Such area limitations were based upon the effectiveness and usefulness of the practice concerned, as demonstrated by farm-management experience of agricultural specialists and of successful farmers.

No fewer than 78 such practices were approved as means of earning soil-building payments. Exhibit 1 in appendix A gives a complete list of these practices, the rates of payment made for adopting them, and the area within which their use was approved for benefit payment.

The practices were divided roughly into four main groups. The first and largest group was for application on general farms and included 45 different practices. These practices included the seeding or establishment of legumes and grasses alone or in mixtures, and the establishment of cover and green-manure crops; establishment, protection, and improvement of forest trees and windbreaks. They also included application of limestone or fertilizing material to soil-conserving crops or pasture; mechanical measures for preventing or controlling erosion; contour plowing and listing and strip cropping.

Another group of 11 practices was designed for orchard and vineyard land. This group included application of mulching material in orchards; plowing or disking in winter cover crops and establishing winter cover and green-manure crops of various types; applying fertilizing materials to soil-conserving crops in vineyards and orchards. Six similar practices were approved for use on commercial vegetable land.

Sixteen different practices were approved for range land. They included natural reseeding of range land, planting and developing of forest trees; contour furrowing, building of earthen dams and reservoirs, developing springs, seeps, and wells, and other means of conserving and efficiently utilizing the water supply; promoting distribution of grazing; and elimination of rodents and undesirable plants.

RATES OF PAYMENT

Rates of payment for adopting soil-building practices reflected in part the difficulty or expense of carrying out the different practices, and in part their relative value as a soil-building activity.

Rates were stated in appropriate units. Establishment of soil-conserving and other crops, for example, rendered the participating producer eligible for payments of a stated amount per acre. Construction of dams and reservoirs earned payments at so much for each cubic yard of material moved in the process. Application of limestone and fertilizing material was paid for at the rate of so much per ton of material applied to a given area. Terrace-building earned payments at the rate of 40 cents per 100 linear feet, fencing at so much per rod, and well-digging at so much per foot.

Soil-building allowance.—For each farm there was calculated the maximum amount in benefit payments which might be earned by the adoption of soil-building practices, regardless of what practices were

carried out. This maximum amount was the "soil-building allowance" for the farm.

The formula for calculating soil-building allowances for different farms was varied according to several different factors. It took into account the type-of-farming area in which the farm was located and, in consequence, the relative effectiveness of various kinds of soil-building practices. It allowed for differences in the farming methods practiced on the farm, and in the agricultural enterprises carried on there. It contained different provisions for diversion farms and for nondiversion farms.

Included in the soil-building allowance, for any farm, was 110 percent of the sum of such of the following items as were applicable:

1. $1 for each acre of commercial orchard, vineyard, and bush fruit on the farm on January 1, 1937.
2. $1 for each acre of cropland on which one crop of commercial vegetables was grown in 1936 and $2 for each acre of cropland on which two or more crops of commercial vegetables were grown in 1936.
3. Either: (a) 50 cents for each animal unit, in excess of five, which the noncrop plowable pasture on the farm would carry during the normal pasture season; or (b) 30 cents for each acre of fenced noncrop open pasture land with a carrying capacity during the normal pasture season of at least one animal unit for each 5 acres. (This rate varied among States and other areas according to their average productivity as compared with the average productivity for all farms in the United States, and applied only to the acreage in excess of one-half of the cropland on the farm.)
4. $1.50 for each animal unit in the average annual carrying capacity of range land on the farm or ranch (to be earned only by carrying out approved range practices).

In addition to the sum of the above items, which could be counted in the soil-building allowance for either a diversion or a nondiversion farm, the soil-building allowance for a nondiversion farm included 80 cents for each acre of cropland, adjusted among States or other areas according to the variation in the productivity of the land as compared with the average productivity for all farms in the United States.

In calculating the soil-building allowance for diversion farms there were added to the applicable numbered items given above, additional items as follows:

1. In the Northeast, East Central, and Southern Regions, $1 for each acre of soil-conserving crops grown on cropland in 1937, not in excess of the sum of the normal acreage of such crops and the maximum acreage which could be diverted, for payment, from the soil-depleting bases.
2. In the North Central Region (except for drylands farms in Nebraska and South Dakota), $1 for each acre in the soil-conserving base plus $1 for each acre diverted from soil-depleting crops in 1937, less $1 for each acre of idle cropland on the farm in 1937.
3. For all farms in the Western Region and for drylands farms in Nebraska and South Dakota, $1 for each acre of soil-conserving crops grown on cropland in 1937, not in excess of the

soil-conserving base, plus $4 for each acre diverted, for payment, from soil-depleting bases (the $4 item to be varied according to the productivity of the farms as compared to the average for the United States).[1]

SUMMARY OF RESULTS

The 1937 program described in the foregoing pages was carried out in all 48 States of the continental United States and in Alaska, Hawaii and Puerto Rico, as planned.

The number of owner-operators, tenants, and landlords who took part in the program totaled 3,743,904. This figure is based on the total number who applied for and earned payments for complying with the program. The number of participants was largest in the States of the Southern Region, where 1,436,800 received soil conservation payments. In the States of the North Central Region, 972,147 participants in the program received such payments. Participants in the States of the East Central totaled 663,415; in States of the Western Region, 456,468; in States of the Northeast Region, 156,643; in the Insular Region, 58,431.

Program covers 65 percent of cropland in farms.—The total acreage of cropland in 3,020,037 farms covered by the program was 282,629,000 acres, or nearly 65 percent of the total cropland acreage in the continental United States. The percentage varied widely for different States. In Wisconsin 86.2 percent of the State's cropland was in farms participating in the program; in Montana, 85.2; in North Dakota, 84.8; and in South Dakota, 83.9 percent. It was as low as 28 percent in Rhode Island, 39.8 percent in Massachusetts, and 39.9 percent in Illinois.

In the 10 States of the North Central Region, 1,192,596 farms were included in the program, and the cropland acreage in these farms totaled 107,798,706 acres. The cropland acreage included in the program was 66,908,000 acres in the Southern Region; 70,654,014 acres in the Western Region; 26,810,318 acres in the East Central Region; and 10,458,303 acres in the Northeast Region.

Payments earned averaged $81.93.—The total of payments (including payments for county association expenses deducted in whole or in part from farm payments) earned for diversion from soil-depleting crops and for soil-improving practices under the 1937 program is tentatively estimated at $306,744,000, not all of which had been disbursed at the close of the fiscal year. Among the different regions, estimated payments are distributed as follows: Southern Region, $100,476,000; North Central Region, $97,967,000; Western Region, $60,475,000; East Central Region, $35,143,000; and the Northeast Region, $10,420,000.

For the United States and insular areas, the payment earned averaged $81.93 per farmer, the average varying among the States from $35.45 for New Hampshire to $348.40 for Arizona. The average for the States in the Western Region was $132.48; in the North Central Region, $100.77; in the Southern Region, $69.68; in the Northeast Region, $66.52; and in the East Central Region, $42.50. The average for the Insular Region was $38.72.

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[1] Preliminary statistics on the acreages on which the various soil-building practices were carried out in 1937 are shown in appendix C.

Programs contribute to farm income.—Farm cash income in the 1937 calendar year totaled $8,600,000,000, a sum which compares with farm cash income of $7,944,000,000 in 1936, and is nearly double the figure for 1932 in which year farm cash income totaled $4,328,000,000. The 1937 income was the highest for any year since 1929.

Soil conservation payments disbursed in 1937 contributed approximately $367,000,000, or more than 4 percent of the total farm cash income for that year. A large portion of the payments disbursed during 1937 was earned by compliance with the program of 1936, and a large portion of payments earned in 1937 was disbursed in 1938 and consequently was not included in 1937 cash income.

However, these payments represent only direct contributions to the 1937 cash income. Besides these payments, the programs had indirect effects upon the farmer's price and income, such as those exerted by restraining the acreage of soil-depleting cash crops; removing price-depressing surpluses from the commercial channels of trade; marketing agreements; and price-supporting loans. The indirect effects of these measures on farm prices and income cannot be accurately gauged.

Participating farms reduce soil-depleting acreage 13 percent.—Of the estimated $304,481,000 in payments to farmers in the continental United States under the 1937 program, about 70 percent was earned by diverting from soil-depleting crops. Roughly 30 percent was earned by effecting soil-improving practices.

Farmers participating in the program diverted 26,362,538 acres from soil-depleting crops. This is almost 13 percent of the normal or base acreage of soil-depleting crops in the participating farms. The total acreage diverted was largest in the States of the Southern Region, which shifted 9,643,533 acres. The diverted acreage in the North Central States was 8,287,183 acres; in the Western States, 6,677,172 acres; in the East Central States, 1,700,542; and in the Northeast States, 54,108.

The acreage diverted from general soil-depleting crops totaled 18,147,000 acres; from cotton, 7,845,493 acres; from tobacco, 278,018 acres; and from peanuts, 91,818 acres.

Estimated payments for diversion (including association expenses) from general soil-depleting crops totaled $128,766,000; for diversion from cotton, $68,672,000; for diversion from tobacco, $11,238,000; and for diversion from peanuts, $731,000. Payments in connection with rice were $2,771,000; and in connection with sugarcane and sugar beets, $3,734,000. Class I payments totaled $215,912,000.

41,000,000 acres seeded to soil-improving crops.—Farmers participating in the program earned approximately $88,210,000 in complying with the soil-building practice provisions of the 1937 program. Such practices included new seedings of legumes and grasses, planting green-manure and cover crops, applying fertilizer and lime, forest and orchard improvement, and mechanical erosion-control practices.

New seedings of soil-conserving crops and cover crops were established on 41,359,365 acres. Approximately 29,000,000 acres were seeded to legumes and perennial grasses, and 12,287,000 acres were seeded to green-manure and cover crops.

New seedings were largest in the North Central Region, where they totaled 15,906,698 acres. In the Southern Region, new seedings totaled 3,367,120 acres, and in addition more than 8,000,000 acres were planted to green-manure and cover crops. In the Western Region there were 3,151,358 acres of new seedings and 1,760,574 acres of green-manure and cover crops. In the East Central Region new seedings comprised 5,472,267 acres, and green-manure and cover crops 2,010,944 acres. In the Northeast Region farmers seeded 1,174,427 acres of alfalfa and other legumes and 366,646 acres of green-manure and cover crops.

More than 5,000,000 tons of lime and fertilizer applied.—In complying for soil payments farmers applied about 4,990,000 tons of lime to their soil for the purpose of encouraging the growth of soil-conserving crops. Approximately 363,000 tons of phosphate fertilizer (16 percent P_2O_5 equivalent) and about 33,000 tons of other fertilizer materials were applied to soil-conserving crops and pastures.

Protected fallowing to conserve moisture is a practice that was applied to 9,545,658 acres, of which more than two-thirds was in the Western Region. Erosion-control practices such as strip cropping and contour or basin listing, were carried out on 6,822,550 acres.

More than 346,600 acres were restored to native covering and 101,128 acres of pasture were reseeded in complying with the program. About 294,000,000 feet of terraces were built.

SOIL CONSERVATION ONLY ONE PHASE OF BROAD PROGRAM

Diversion from soil-depleting crops and other soil-conserving practices constituted only one phase of a broad program which is pointed toward the objective of maintaining farm income at adequate levels, of conserving the resources of fertility in the soil of American farms, and of stabilizing supplies from farm production at adequate levels.

This broad program also includes measures designed to keep surpluses from depressing prices, to expand the market for farm production at home and abroad, to provide for more orderly marketing of farm products, and to provide food and clothing for that portion of the population which lacks buying power. These phases of the program are discussed elsewhere in this report.

IV. THE 1937 RANGE CONSERVATION PROGRAM

The Agricultural Adjustment Administration sought to extend the principles of conservation to the largest practicable proportion of all kinds of farm land, including Western range lands as well as cropland. Hence the 1937 programs included a range-conservation program. This represented modification and improvement of the 1936 range program, and made the program applicable to a greater area of privately owned range land. The 1937 program and the modifications from 1936 which it embodied were formulated after conferences with stockmen in all States where there are open ranges.

In formulating the program, special attention was given to providing for encouragement of range-conserving practices which had been tested and found adaptable and effective in the areas for which they were approved.

Range operators were encouraged to adopt range-conserving practices through benefit payments conditioned on the performance of these practices. In the range-land areas, diversion of acreage from soil-depleting crops was not practical as a principal soil-conserving measure because the proportion of cropland on ranches in range territory is relatively small. Hence the opportunity was presented to earn benefit payments on the basis of conservation of the range but without regard to acreage bases or the soil-conserving use of cropland.

Total benefit payments on any ranching unit were limited to the amount of the range-building allowance. This limit or allowance was calculated for all areas on the basis of the appraised grazing capacity of the range land on the ranch. It amounted to $1.50 for each animal unit in that grazing capacity.

Practices which could be followed in order to earn benefit payments were those which had demonstrated that they would tend to check depletion of forage and erosion of land. They included measures for the conservation and more efficient utilization of both vegetation and water. Payments were made, within the limits of the range-building allowance, at rates specified for the different practices.

Range-conservation provisions were made for all States in the Western Region, for Texas and Oklahoma in the Southern Region, and for South Dakota and Nebraska in the North Central Region. Practices approved for payment were not the same in all States. Any given practice was approved only in those States where it would be effective. Rates of payments for the same practice also varied among States. These variations were designed to make the program applicable to widely different conditions in different areas.

WESTERN RANGE PRACTICES

In the Western Region a list of 10 approved practices, with the rate of payment to be earned through each, was announced. The practices and rates which applied in some or all of the 13 States in the Western Region were as follows:

1. Contour furrowing, 50 cents an acre.
2. Development of spring and seeps, $50 for each spring or seep.
3. Construction of earthen reservoirs, 15 cents per cubic yard of excavation.
4. Digging or drilling wells, $1 per foot of depth.
5. Water spreading with permanent ditching, 10 cents per linear foot of such ditching.
6. Constructing fences to bring about better distribution of grazing, 30 cents per rod of fence.
7. Eliminating range-destroying rodents, different rates in different States and for different rodents.
8. Reseeding depleted range land with good seed of adapted varieties of perennial grasses, 20 cents per pound of seed sown.
9. Establishing fire guards, 3 cents per 100 linear feet.
10. Natural reseeding by deferred grazing, 35 cents per animal unit withheld from the range, for each month during the period from the start of forage growth to seed maturity. This practice involved pre-

vention of grazing on not more than 25 percent of the range land on the ranch. To fulfill the purposes of the practice it was necessary to reduce the number of animals grazed on the ranch. Numerous special provisions governed the application of the practice.

PRACTICES IN OTHER AREAS

In Texas and Oklahoma 10 practices were approved. This list included reseeding by deferred grazing (under different provisions and at a different rate of payment than in the Western Region), contour furrowing (at the rate of 70 cents an acre), constructing earthen dams and reservoirs, building range fences, establishing fire guards, and eradicating rodents. All but the first two of these practices were in the list for the Western Region at the same rates.

In addition, the Texas-Oklahoma program included:

1. Ridging or terracing range land, 10 cents per 100 linear feet of terrace.
2. Constructing spreader dams, 15 cents per cubic yard of excavation.
3. Constructing spreader terraces, 40 cents per 100 linear feet.
4. Rescuing range land from infestation by harmful vegetation, at rates determined by the kind and degree of infestation.

In Nebraska and South Dakota, the practice of deferred grazing as a means of permitting natural reseeding of depleted range land was important. Payment in those States for this practice was fixed at 60 percent of the total range-building allowance for the ranch. Limiting grazing was a similar practice approved in these States, and the payment for limited grazing was an amount equal to 50 percent of the total range-building allowance.

Contour furrowing and construction of earthen reservoirs were approved at the same rates of payment that were in effect in the other regions. Tree planting and the protection and maintenance of a stand of trees were approved in Nebraska and South Dakota, the payment rate for planting being $10 per acre and that for maintenance, $4 per acre.

RESULTS OF 1937 RANGE PROGRAM

Range conservation and improvement practices encouraged under the 1937 program were carried out on 37,455 ranches in 17 States. These ranches comprised a total acreage of more than 154,500,000 acres, with a total grazing capacity of approximately 6,584,000 animal units.

The States in which the range program applied were: South Dakota and Nebraska in the North Central Region; Oklahoma and Texas in the Southern Region; and the following States in the Western Region: Arizona, California, Colorado, Idaho, Kansas, Nevada, New Mexico, North Dakota, Oregon, Washington, Montana, Utah, and Wyoming.

Natural and artificial reseeding was carried out on more than 15,000,000 acres of land. This included 12,841,000 acres reseeded by

deferred grazing; 2,365,000 acres reseeded by limited grazing; and 80,860 acres reseeded to adapted varieties of range grasses, legumes, and forage shrubs. More than 1,567,000 rods of fences were constructed to control grazing. Practices for rodent control were carried out on 3,582,638 acres. These practices were pointed directly to the maintenance or increase in carrying capacity of range land.

To increase water supplies for livestock on range land, earthen dams, tanks, pits, and reservoirs with a total capacity of more than 31,000,000 cubic yards were constructed. This practice was carried on in all the range States. In addition, ranchers in States in the Western Region dug 1,311 wells and constructed 11,640 seeps and springs to develop natural watering places for livestock.

Measures to control erosion and water run-off included the construction of 3,252,741 lineal feet of spreader dams and terraces; the contouring of 60,068 acres of land; and, in Oklahoma and Texas, 19,957,000 feet of contour ridging of range land.

More than 13,000,000 lineal feet of fireguards were established in range States of the Southern and Western Regions. These guards were constructed by exposing soil in strips at least 10 feet wide.

In Texas and Oklahoma, where payments were available for the elimination of destructive plants from range land, the program resulted in the eradication of prickly pears and cactus on 1,053,600 acres of range land; eradication of mesquite on 110,800 acres; and eradication of cedars and lechuiguilla on 513,000 acres.

Miscellaneous practices for which payments were made included the planting of more than 1,400 acres of forest trees, construction of tanks and troughs, and elimination of sage brush.

V. SUGAR PROGRAM UNDER THE SUGAR ACT OF 1937

The Sugar Act of 1937, approved on September 1, 1937, is in many respects similar to the former Jones-Costigan Act. Continuance of the quota system established under the Jones-Costigan Act after invalidation of the processing taxes and production-adjustment contracts had resulted in a redistribution of the aggregate income of the sugar industry in a manner detrimental to the interests of growers and agricultural laborers. The Sugar Act of 1937 was intended primarily to remedy this situation.

SUMMARY OF SUGAR ACT OF 1937

In outline the act provides that the Secretary of Agriculture shall estimate the annual consumption requirements of the continental United States and allot the quantity so estimated, as quotas, in accordance with a formula set forth in the act, among the areas supplying the continental needs.

If necessary to insure an adequate and orderly flow of sugar in the channels of interstate and foreign commerce, to prevent disorderly marketing, or to afford all interested persons an equitable opportunity to market sugar, any quota may be allotted to persons who market or import sugar.

The act also provides for the imposition of an excise tax at the rate of 50 cents per 100 pounds of 96° raw sugar with an import compensating tax of like amount. It provides for conditional payments to

producers at a basic rate of 60 cents per 100 pounds of recoverable sugar, raw value, with certain downward graduations for large producers.

The conditions required to qualify a producer for payments generally involve the elimination of child labor (other than that of the immediate members of the producer's family), the payment of fair and reasonable wages, the preservation and maintenance of the fertility of the soil, marketing of no more than the farm's proportionate share of the quota of the area in which it is located, and, if the producer is also a processor, the payment of fair and reasonable prices for the sugarcane or sugar beets purchased from other producers. In addition, there are provisions permitting abandonment and deficiency payments in the event of certain natural calamities.

QUOTA ADMINISTRATION

Early in 1937 quotas for the calendar year were established under Public Resolution No. 109. On September 2, 1937, immediately following the approval of the Sugar Act of 1937, quotas were issued in accordance with its provisions. On December 20, 1937, the initial estimate of continental sugar requirements and allocation of quotas for the calendar year 1938 were announced. The 1938 quotas as established by the more recent regulations, together with the final quotas for 1937, were as shown in table 3.

TABLE 3.—*Sugar quotas for 1937 and 1938*

Area	Quotas in short tons, 96° raw value	
	1937	1938 [1]
Domestic areas:		
Domestic beet sugar	[2] 1,417,009	1,572,557
Mainland cane sugar	472,337	426,309
Hawaii	[2] 984,210	951,751
Puerto Rico	897,063	809,648
Virgin Islands	10,023	9,046
Total domestic	3,780,642	3,769,311
Foreign countries:		
Commonwealth of the Philippine Islands	[2] 998,499	[2] 991,019
Cuba	2,148,951	1,939,543
Foreign countries other than Cuba	114,641	80,683
Total foreign	3,262,091	3,011,245
Total of quotas	7,042,733	6,780,556

[1] General Sugar Quota Regulations, Series 5, No. 1, Rev. 1.
[2] After reallotment of deficit.

The quota provisions of the Sugar Act require that the basic factor for determining the sugar requirements of consumers in the continental United States shall be the quantity distributed for consumption during the 12-month period ending October 31 next preceding the calendar year for which the determination is made. Whereas the distribution of the quotas, other than those of the domestic sugar-beet area and the continental cane area, under the Jones-Costigan Act was based upon the volume of importations from each source

during the 3 most representative years in the period 1925–33, the distribution of the quotas to the several producing areas under the Sugar Act of 1937 represents exact percentages, as set forth in the act, of the estimated continental consumption requirements.

In the administration of the quota plan it is required that deficiencies found in any area's quota supply be reallocated. Pursuant to this provision deficits which were found in Hawaii, the Commonwealth of the Philippine Islands, and the domestic beet area in 1937 were reallocated, and a 1938 deficit found in the quota supply of the Commonwealth of the Philippine Islands has been reallocated to foreign countries other than Cuba.

In order to prevent disorderly marketing of Puerto Rican sugar, the mainland sugar quota and the local consumption quota for that area have been distributed in the form of marketing allotments. The 1938 local consumption requirements for Hawaii and Puerto Rico have been determined to be 29,285 and 73,851 short tons of sugar, raw value, respectively.

As in previous years, the Bureau of Customs has cooperated with the Agricultural Adjustment Administration in maintaining administrative control over importations of sugar at ports of entry.

Conditional payments.—In order to qualify for conditional payments producers are required to meet certain standards established pursuant to title III of the act. The payments are made at a basic rate of 60 cents per hundred pounds of commercially recoverable sugar, raw value. The rate decreases as the quantity of sugar produced on the farm increases, and reaches a minimum of 30 cents on that portion of the total quantity of sugar or liquid sugar produced on the farm in excess of 30,000 short tons. The quantity of commercially recoverable sugar, raw value, has been calculated from statistics of recoveries in prior and current years.

Abandonment or crop deficiency payments are provided for in the event of bona fide abandonment and crop deficiency caused by drought, flood, and similar causes. Deficiency payments are authorized on an amount of sugar equal to the difference between the actual yield and 80 percent of a normal yield. Abandonment payments are provided for only on an amount of commercially recoverable sugar, raw value, equal to one-third of the normal yield of the abandoned acreage.

In his message to Congress with respect to sugar, the President on March 1, 1937, stated that:[2] "The social and economic effects of an adequate excise tax on sugar are so important to the welfare of the various groups affected as to constitute a necessary complement to the quota system."

One of the purposes of the conditional payment and tax plan is to distribute the aggregate income within the sugar industry in such manner that each of the various groups within each area will be treated equitably. It was found that without a tax and conditional payments (as was the case during parts of 1936 and 1937), processors generally were earning large profits while the income of labor and of the producer was sharply restricted in relation to the general advance which occurred.

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[2] The full text of the message is given in exhibit 28 of appendix H.

The act requires that a processor who is also a producer and as such applies for a conditional payment must, under section 301 (d), pay for sugar beets or sugarcane at rates not less than those determined after investigation and due notice and opportunity for hearing, to be fair and reasonable. Section 301 (b) sets forth the same requirements with respect to hearings on fair and reasonable wage rates. In the interest of economy, the hearings on both problems have been conducted at the same time and place by the same presiding officer.

In the mainland sugarcane area the rates agreed upon between processors and producers for cane of the 1937 crop were based primarily upon a determination of fair and reasonable prices for the 1935 crop made under the former program and have been deemed to be fair and reasonable for conditional payment purposes for 1937. Because of the freeze which occurred after grinding was well under way a supplemental determination of rates for frozen cane was found necessary. Under the supplemental finding deductions in price were permitted at a rate of 3.775 percent of the price otherwise required for each 0.25 cc of the acidity above 2.25 cc.

In the sugar-beet area the rates established in the purchase agreements entered into by processors and cooperative bargaining associations of growers and in use in 1937 were approved for that year, and in those agreements voluntarily made between producers and processors with respect to the 1938 crop such agreements have been determined to be fair and reasonable for that crop. In the absence of an agreement with respect to the 1938 crop, rates not less than those set forth in the 1937 contracts were approved as fair and reasonable, provided a minimum of $5 per ton were paid for sugar beets containing 16.5 percent sucrose in the cossettes or 16.8 percent sucrose in the beets, the minimum price for beets containing more or less sucrose to be varied in direct proportion to the quantity of sugar in the beets.

In the case of Puerto Rico, rates equal to those prevailing in 1936–37, provided the producer received not less than 63 percent of the recoverable sugar and provided further that the cane was of a sufficiently good quality to yield not less than 9 pounds of sugar per 100 pounds of cane, were approved for the 1937–38 season (commonly known as the 1938 season) and a definite formula for the determination of recoverable sugar was set forth. Payment could be made either in the form of sugar or the money value of the recoverable sugar, the money value to be determined in accordance with the average price of 96° sugar, f. o. b. mill basis. In the case of canes other than those of the "noble" types, rates not less than those established in the previous grinding season by agreement between the grower and processor could be used. For Hawaii, the prices agreed upon between growers and processors for sugarcane harvested after July 1, 1937, will qualify the processor-producer for conditional payments.

Labor requirements.—The act specifically states that no child under the age of 14 years, other than a member of the immediate family of the legal owner of not less than 40 percent of the crop, may be employed in the production, cultivation, or harvest of a crop of sugar beets or sugarcane if the producer is to receive a conditional payment.

The act also requires that no child between the ages of 14 and 16 years, other than with the exception noted above, shall be employed for longer or be permitted to work for longer than 8 hours a day. It requires that wages of everyone employed on the farm in the production, cultivation, and harvesting of sugarcane shall have been paid, and paid at rates not less than those deemed by the Secretary of Agriculture to be fair and reasonable.

To effectuate the labor provisions of title III of the act a determination of fair and reasonable wages for harvesting the 1937 crop of sugar beets was issued on January 25, 1938. This determination required a maximum increase in the harvesting rate of 12 cents per ton, and provided that if topping rates (the only rate in question at the time) of not less than $7.50 per acre of beets yielding 7 net short tons per acre, and 75 cents for each additional ton, had been paid, no additional wage payment was required to qualify the farm for a conditional payment. This determination applied only to harvesting done after September 1, 1937.

On April 4 a determination which applied to all beet work in connection with the 1938 crop was issued. It divided the country into 7 districts and established rates for each. These are the only two wage determinations applying to the sugar-beet area that have been issued between September 1, 1937, and the completion of the harvest of the 1938 crop.

The first determination of fair and reasonable wages for the domestic sugarcane area was issued on November 12, 1937. It was applicable to the harvesting of sugarcane in the Louisiana area. A supplementary determination providing harvesting rates for Florida was issued on March 30, 1938, and applied to the period from September 1, 1937, to June 30, 1938. A similar determination of fair and reasonable rates for the planting and cultivating of sugarcane in the mainland sugarcane area has been issued for 1938.

Fair and reasonable wages for persons employed in the production, cultivating, or harvesting of sugarcane in Puerto Rico during the calendar year 1938 were established on February 23, 1938, at levels agreed upon between producers and bargaining agencies of workers. These wage rates applied to the several seasonal operations. On April 1, 1938, a determination applying to all operations performed in Hawaii during the period from September 1, 1937, to December 31, 1937, was issued.

Proportionate shares.—As a further condition for payment the producer was required to market an amount of sugar beets or sugarcane (measured in terms of planted acreage, weight, or recoverable sugar content) not in excess of the proportionate share for the farm, the sum of the proportionate shares to represent the total quantity of sugar beets or sugarcane required to be produced in order to meet the quota of the area involved.

In the case of the mainland cane area the proportionate share for a farm for 1937 was established as the amount of sugarcane (for sugar) produced on the farm. On September 29, 1937, proportionate shares for 1938 for farms in the mainland sugar-cane area were determined on an acreage basis. Basically the share of each farm was determined to be the quotient of the sum of the average acreage of sugarcane for sugar during 1935 and 1936 plus the 1937 acreage divided by two, provided the resulting figure

represented not less than 5 acres nor more than 60 percent of the cropland on the farm suitable for the production of sugarcane. Provision was also made for new growers and exceptional cases.

The proportionate shares of farms in Puerto Rico were basically dependent on the provisions of Puerto Rico Sugar Order No. 5, issued in 1936, establishing marketing allotments for individual farms. The allotments in that order were in terms of short tons of sugar, raw value. In 1938 these allotments were multiplied by a fraction whose numerator was the sugar quota established for the area for 1938 corrected, if necessary, for inventory, and whose denominator was the total of the previous bases, plus the bases established for new growers. Special provisions were made for new growers. A similar procedure has also been established with respect to the 1939 crop.

For the protection of sharecroppers and tenants, general provisions designed to prevent the diversion of payments from the tenants and sharecroppers to the landlord have been included in the proportionate-share determinations. In addition, it is required that no producer shall interfere with contracts heretofore entered into by tenants or sharecroppers for the sale of their crop.

In view of the fact that domestic beet-sugar production has not been as large as the quota, the proportionate share of each farm in the domestic sugar-beet area for 1937 and 1938 has been determined to be the quantity of sugar beets harvested for sugar. A similar determination for Hawaii for 1937 establishes the quantity of sugar produced subsequent to June 30, 1931, as the proportionate share for the farm for that year.

Farming practices.—Under the Soil Conservation and Domestic Allotment Act continental producers of sugar beets and sugarcane received payments with respect to these crops for carrying out certain minimum conservation practices. The basis of the requirements under the Sugar Act of 1937 was taken from the program under the Soil Conservation Act. If such agricultural practices had been followed as would qualify the farm for at least one-half of the maximum payment which could have been earned with respect to sugar beets or sugarcane under the Agricultural Conservation Program in 1937, the farm was considered to have qualified with respect to soil-conservation practices for that year.

In the case of Hawaii and Puerto Rico minimum fertilizer standards based on those required for conditional payments under the Agricultural Conservation Programs were adopted for the 1937 crop year, some differentiation being made between small and large farms.

For 1938 in the domestic sugar-beet area, seeding and maintenance of adapted biennial and perennial legumes and perennial grasses, the use of green-manure crops, and the application of barnyard and commercial fertilizers in stipulated quantities have been included as alternative practices. It is anticipated that requirements similar to those of the previous year will be established for the remaining sugar-producing areas.

Field administration of conditional-payment provisions.—While all of the determinations of conditions, preparation of administrative forms, and preparation of instructions relative to determining whether the stipulated conditions have been complied with are prepared in the Sugar Section of the Adjustment Administration, the

necessary field work is done by the State and county agricultural conservation committees under the general direction of the several regional divisions established for the administration of the Soil Conservation and Domestic Allotment Act and the Agricultural Adjustment Act of 1938. The details of the organizational structures differ slightly as between regions but are essentially similar.

In the case of the domestic offshore areas the programs, other than the quota programs, are administered through the Insular Division of the Agricultural Adjustment Administration.

RESULTS OF THE PROGRAM IN 1938

At the close of the fiscal year on June 30, 1938, the Sugar Act of 1937 had been in operation for 10 months. During that period, income of the industry as a whole was maintained, and the proportionate share received by growers and labor was larger than it was in the previous 10 months.

Participation in the program is indicated by the number of applications for conditional payments received from growers. These applications totaled 69,618. The total amount of the payments due to growers in 20 sugar beet-producing States, 2 sugarcane-producing States, and in the insular areas of Hawaii and Puerto Rico is estimated at $36,847,000.

During the period that the act was in effect, the wholesale price of refined sugar, net excluding tax, averaged $4.112 per 100 pounds. This compares with $4.684 per 100 pounds for the same 10 months of the preceding year. However, conditional payments at the rate of 60 cents per 100 pounds, which is equal to 64.2 cents per 100 pounds refined basis, were made to producers under the Sugar Act of 1937. Including these payments, the returns of the industry as a whole approximated $4.75 per 100 pounds, which is above the average returns for the preceding 10 months. As a result of the operations of the act, producers and laborers received a greater share of these returns.

The 1937 sugar-beet crop, the first to be marketed under the new law, will probably give the growers an income per ton equal on the average to parity prices. There will be some decline in the income to processors. Including conditional payments, the income to growers will average close to $10 an acre over that of the preceding year. These payments are graded downward for large producers. Independent growers of sugarcane are expected to benefit similarly. Estimates of payments to be made to producers on the 1937–38 sugar beet and sugarcane crop are given in exhibit 24 of appendix F.

Wage rates established under the provisions of the act represented an increase over wages that previously prevailed in each of the sugar-producing areas. The increase for the 1937 crop was about 6 percent in the sugar-beet areas, 8 percent for the mainland sugar area in Florida, and 20 percent in Louisiana. In Puerto Rico, sugarcrop wages in 1938 increased about 10 percent above the highest standard rates paid by any group of Puerto Rican producers in 1937. The increase in wages for work done in the Hawaiian sugarcane crop between September 1 and December 31, 1937, varied for different plantations between 5 and 20 percent.

No appreciable increase in the average cost of sugar to consumers has resulted from the imposition of the excise tax. The tax was at the rate of 50 cents per 100 pounds of 96° raw sugar. In the 10 months during which the Sugar Act of 1937 was in effect, the retail price of sugar averaged 5.6 cents per pound, or practically the same as the average price during the year that preceded the enactment of the legislation.

VI. ACTIVITIES OF THE CONSUMERS' COUNSEL DIVISION

The Consumers' Counsel Division during 1937 directed its activities toward two major ends. (1) It represented the American consumer during the formulation and administration of the various phases of the farm program, and (2) it assembled information for publication and for distribution among consumers designed to help them understand those agricultural problems which affect them, and also to assist them in the intelligent selection and utilization of agricultural products.

PARTICIPATION IN PLANNING AND ADMINISTERING PROGRAMS

At the conferences and hearings during 1937 on the agricultural conservation program, marketing agreements, and proposals for diversion of surplus farm products, Consumers' Counsel Division economists inquired into the effect of the proposals under consideration upon consumers. Upon the basis of analyses showing the probable effects of each proposal upon prices and supplies the Consumers' Counsel Division recommended the modification, the acceptance, or the rejection of the various programs, with the welfare of consumers uppermost in mind in each case.

This activity of the Division is founded upon section 7a (5) of the Soil Conservation and Domestic Allotment Act which provides that the act—

> * * * shall not be used to discourage the production of supplies of foods and fibers sufficient to maintain normal domestic human consumption as determined by the Secretary from the records of domestic human consumption in the years 1920 to 1929, inclusive, taking into consideration increased population, quantities of any commodity that were forced into domestic consumption by decline in exports during such period, current trends in domestic consumption and exports of particular commodities, and the quantities of substitutes available for domestic consumption within any general class of food commodities. In carrying out the purposes of this section, due regard shall be given to the maintenance of a continuous and stable supply of agricultural commodities adequate to meet consumer demand at prices favorable to both producers and consumers.

Cooperating with the Sugar Section of the A. A. A. in the administration of the consumer-protection provisions in section 201 of the Sugar Act of 1937, the Division prepared technical data relating to the sugar needs of consumers to assist in the determination of the amount of sugar necessary for domestic requirements. Under the section cited the Secretary of Agriculture is required to consider sugar consumption and prospective changes in population, and consumer incomes in the administration of the Sugar Act.

Wherever consumer interests fell within the scope of the work of special committees in the Department, the Division participated in their work. Emphasizing consumer requirements, for example, the Division assisted in the preparation of a mimeographed report on distribution of live and dressed turkeys which was prepared at the request of turkey growers.

Commercial meat grades and their relative importance in indicating the palatability of meat to consumers are the subject of another special cooperative study now under way. This study was undertaken in 1936 under the joint sponsorship of the Division, the Bureau of Home Economics, the Bureau of Animal Industry, and the Bureau of Agricultural Economics.

To meet a need for factual material on the relationship between family income and the consumption of a given food, the Division prepared preliminary charts giving data for potatoes and sweetpotatoes, tomatoes, leafy, green, and yellow vegetables, other vegetables, fruits except citrus, poultry meats, eggs, and milk. This information is based upon analyses and summaries of the data compiled in the Study of Consumer Purchases made by the Bureau of Home Economics and Cost of Living Section of the Department of Labor, and is given for the entire country and also by types of communities.

Consumption of meat and of butter, oleomargarine, and other fats is now the subject of a study being carried on by the Consumers' Counsel Division. The study deals with the per capita consumption of these commodities in relation to per capita income of about 1,500 families of wage earners and members of low-income groups in Birmingham, Boston, Detroit, and Los Angeles. The data were made available by the Department of Labor. The report will include average prices paid for each commodity.

Consumer preferences with respect to citrus fruits were studied in a survey completed this year. Undertaken in 1936 to supply factual data for the administration of the farm program on citrus fruits, the survey is based upon interviews with 1,000 housewives in St. Louis and a similar number in Baltimore. The attitudes and preferences of these housewives in regard to fresh oranges, fresh grapefruit, canned orange juice, canned grapefruit juice, and five other allied products have been summarized and analyzed in a final report, issued as Publication 6 of the Consumers' Counsel Series.

Nonfarm sources of income for persons living on farms is the subject of another study begun in 1937 which will be completed in 1938. This study was undertaken in cooperation with the Farm Income Committee of the Department.

In addition to the foregoing activities, the research section of the Division, as a regular function, analyzed data on supplies and prices in order to determine the probable effect of the farm program on consumers. Records of retail prices of foods and other farm products and of changes in retail prices compared with consumers' incomes were kept. Studies were made of the spread between farm and retail prices, processors' margins, and financial statements of producers. This information has been used primarily in conjunction with the administration of the farm program, but also has been made available to consumers through the Consumers' Guide, press releases, public addresses, and radio programs.

INFORMATION FOR CONSUMERS

An articulate consumer movement, highly significant to agriculture, has developed in recent years according to the Consumers' Counsel Division, and is growing rapidly. New evidence is accumulating steadily from city and farm women's organizations, from city and farm cooperatives, from trades, the press, and schools and colleges, indicating that consumers are becoming more conscious of their economic interests as buyers and more insistent that those interests shall carry weight in the plans and operations of producers and distributors. The Consumers' Counsel feels that particularly with regard to feeds and other agricultural products these consumers are studying and acting upon problems of wise selection, expenditure, and consumption and of evaluating the agricultural program in its relation to consumer needs.

The evidence in the hands of the Consumers' Counsel indicates that this movement is expressing itself through a demand for more facts about the goods consumers buy. It has been estimated that more than 5 million women engaged in 1937 in organized study of their buying problems. The movement expresses itself in negotiation with business for better buying information through retailer-consumer and industry-consumer councils. Government agencies advising in the formulation of trade rules and administering trade-practice laws have felt the pressure of this movement in a demand for presentation of the consumer side of the problems they work on.

The consumer movement engages in the distribution of goods through cooperatives which, according to information of the Consumers' Counsel, claim membership of more than a million and a third families, many of them farm families, and in 1936 did a business of nearly $300,000,000.

Intelligent action by consumers must be based upon accurate and relevant information. Gathering this information for consumers, and helping to put it in form for their use, has been one of the important activities of the Consumers' Counsel Division. This information has fallen into four main categories:

(1) Information on the selection and utilization of farm products to enable consumers to purchase more wisely and more economically.

(2) Market information and news of current agricultural developments to enlarge and stabilize markets for farm products.

(3) Information on agricultural problems including that which bears upon the points of mutual interest between them and farm producers.

(4) Replies to inquiries on a wide variety of consumer problems.

The mediums used in informing consumers have included the Consumers' Guide, the Consumers' Market Service, a weekly radio program, special bulletins, press releases, addresses by members of the staff of the Division, and voluminous correspondence.

Publication of the Consumers' Guide.—The Consumers' Guide has been the most important channel of information to the consumers. The Guide is published twice each month and has a circulation of

135,000 housewives, students, extension agents, editors, teachers, municipal and State officials, and workers in social and welfare agencies.

Housewives have learned through it how to purchase food economically and have been encouraged to introduce new fruits and vegetables into their family menus for greater nutrition and more healthful diets. Through the Guide the Consumers' Counsel has sought to increase realization among consumers as to their civic responsibilities, and has encouraged them to form study groups and consumer clubs. Cooperation between consumers and Government agencies has been encouraged.

Consumers learning of farm surpluses through the Guide have extended the effectiveness of their own purchases and at the same time helped relieve these market congestions. In college and high school economics classes the Guide is used sometimes as a text and sometimes as standard reference material. Editors of farm magazines, of labor papers, of daily papers, and of general magazines, have reprinted its articles in whole or in part. State and Federal officials have enlisted the Guide's aid in securing consumer cooperation for their agencies. Social workers use the Guide in their efforts to help families on low incomes or families receiving public assistance maintain healthful diets despite their inadequate incomes. Extension agents have used the Guide as basis for discussion in club work.

Besides setting forth the goals of agricultural adjustment and describing the broad objectives of consumers, Guide articles have dealt with specific commodities, definite problems, and the actual work of various Government agencies. As an example of commodity information, milk was given extended treatment in one series of Guide articles; dairymen's problems, the problems of milk marketing, the methods of handling milk, milk laws and regulations were all described simply and authoritatively. These articles also gave specific advice on the selection and use of dairy products. Articles appeared on the work of the Food and Drug Administration, the Consumers' Purchase Study, the Federal Trade Commission, and the Rural Electrification Administration and other similar agencies.

Other consumer services.—Since its inception, the Consumers' Counsel Division has become a focal point toward which consumers turn for many different kinds of information. Many inquiries are answered by the Division itself, frequently at the expense of considerable research work. At least 10,000 such inquiries have been handled in the course of the year.

An acute need for material suitable for use in consumer study groups became evident. To meet this need a 12-page bulletin, "A Study Plan for Consumers," was prepared. It describes eight subjects for discussion and contains references to source material in the Consumers' Guide. This booklet is now being revised for reissue in 1938.

The final installments of the Consumers' Bookshelf, a bibliography of low-cost bulletins and publications by Federal agencies and selected impartial agencies, appeared in the Guide during 1937. This bibliography brings together a list of references to material on selection and use of various products for use in schools, study groups, and all other groups hampered by lack of sufficient inexpensive study material. This bibliography was prepared in cooperation with the Consumers Project of the Department of Labor.

To obtain an accurate picture of the present state of consumer education, the Division, in cooperation with the Office of Education of the Department of the Interior, made plans for a nationwide survey of this field. Questionnaires have been printed which will be sent to approximately 150 colleges and 500 high schools. This survey is intended to present for the first time a comprehensive picture of the extent of consumer education in the United States.

Consumer Market Service.—Information on changes in food supplies and prices is distributed through the Consumers' Market Service, a 2-page mimeographed bulletin issued semimonthly to about 1,800 individuals, most of whom are nutrition specialists concerned with quantity food purchases, buyers for consumer clubs and cooperatives, and editors of food journals.

Radio.—In collaboration with the General Federation of Women's Clubs, the Division broadcasts discussions of consumer problems once each week over a national network. "Consumer Time on the Air" is designed to promote a better understanding of the consumers' interest in the agricultural program and to acquaint consumers with Government information and services available in helping them meet individual problems.

COST OF LIVING IN 1937

Living costs continued moving up in 1937, but the advance was almost entirely in nonfood items. Food costs in December were slightly below December 1936 because a marked decline in food prices during the last half of 1937 canceled the entire increase of the first half. The cost of nonfoods, however, went up steadily during the year, registering an advance of 4 percent. While the cost of living declined slightly during the last quarter of the year, as a result of lower food prices, only a small part of the advance of the first 9 months was canceled.

The index of the cost of living for wage earners and low-salaried workers, as reported by the Bureau of Labor Statistics, increased 2.5 percent from 82.4 to 84.5, from December 1936 to December 1937. Living costs were 10 percent higher than in December 1932, but 13 percent lower than in December 1929.

For the second successive year house furnishings and rent exhibited the sharpest increases of the six items included in the index. The former went up 10.5 percent, while rents jumped 6 percent. Clothing costs increased 5.5 percent, while miscellaneous items were 1.9 percent higher. Fuel and light, and food, the only two items which declined, went down 0.6 percent and 0.3 percent, respectively.

Consumer income went up more than living costs during 1937. Labor income as reflected in factory payrolls increased 19 percent, and the per capita income of the nonfarm population increased 9.5 percent.

MARGIN BETWEEN FARM AND RETAIL PRICE OF FOOD

Accurate information on the distribution costs between the farmer and the ultimate consumer is essential to the protection of the consumer's interest under an agricultural program. Since the Depart-

ment of Agriculture has no authority to require middlemen to report such cost information, and little authentic information of this kind has been forthcoming voluntarily from middlemen, margin studies made by the Consumers' Counsel Division have been based on price series collected by Government agencies. The current records kept by the Division on retail prices, farm prices, and share of the consumers' food dollar received by farmers and middlemen, are obtained from the Bureau of Agricultural Economics.

The farmers' share of the consumers' retail dollar spent for food advanced 1 cent from 1936 to 1937, marking the fifth successive year in which an increase has occurred. Annually since the farmers' share reached its low level in 1932, farmers have received an increased proportion of the retail food dollar and middlemen have obtained a smaller share. During this 5-year period the farmers' share jumped 12 cents, or 35 percent. The increase from 1936 to 1937 was smaller than in other recent years, but the farmers' share reached its highest level since 1929.

The distribution of the retail food dollar between farmers and distributors, based upon the estimated farm and retail cost of the quantities of 58 foods purchased annually by a typical workingman's family, is given in table 4. From 1936 to 1937 the average retail cost of this food bill went up from $342 to $353, or $11. During this period average annual wages per employed worker in the manufacturing industries went up from $1,094 to $1,205. Most of this increase in the food bill went to farmers because the average farm value of these foods went up from $152 to $160, or $8. The share of distributors advanced $3, to a total of $193. As a result, farmers received 45 cents of each retail food dollar in 1937, compared with 44 cents in the previous years. The farmers' share of the food dollar in 1937 again was substantially below the amounts received in the years prior to 1920, but changes in distribution services and methods between these two periods limit the comparability of the figures.

TABLE 4.—*Data on costs of living, farmers' share of retail food costs, and related material*

Percentage decrease in retail food costs, December 1936 to December 1937	0.3
Percentage increase in cost of living, December 1936 to December 1937	2.6
Percentage increase in per capita nonagricultural income, 1936–37	9.6
Percent of retail food cost in December 1937 to 1924–29 average	79.6
Percent of cost of living in December 1937 to 1924–29 average	84.0
Percent of per capita nonagricultural income in December 1937 to 1924–29 average	87.1

Retail value and farm value of 58 foods consumed annually by a typical workingman's family, and farmer's share in the retail price, for specified years:

Year	Retail value	Farm value	Farmer's share in retail dollar
	Dollars	*Dollars*	*Cents*
1929	415	195	47
1932	270	88	33
1936	342	152	44
1937	353	160	45

The increased share in the consumers' retail food dollar that was received by farmers during 1937 does not include Government benefit payments which increased farmers' incomes. These benefit payments have not been included under the farmers' share in table 4. If they were included, the farmers' share would be higher than indicated and probably would show a decrease instead of an increase from 1936 to 1937. Processing taxes in effect from 1933 to 1935 have been included as part of the margin between farm and retail values.

VII. EXPERIMENTAL COUNTY CONSERVATION PROGRAMS

Concurrently with the operation of the agricultural conservation programs, studies of their adaptability and the effectiveness of different methods were needed, especially in respect to meeting regional problems.

Consequently under the 1937 program, there were established for 10 counties in the United States special conservation programs which differed in provisions and methods from the programs of the regions in which these counties were located. The purpose was to permit farmers in the 10 counties to use special ideas or local recommendations constituting the experimental programs as laboratories in which modifications of the regional programs could be tested out. The experimental programs grew out of suggestions of farmers, State specialists, and members of the Agricultural Adjustment Administration. At the conclusion of the experiment, their results could be compared with those achieved under the regional programs.

Authority for the establishment of such special programs within counties was contained in provisions of the Soil Conservation and Domestic Allotment Act authorizing surveys and research to determine the most effective means of effectuating the purposes of the act.

These special experimental programs were designed to assist in the solution of at least two different types of problems. One was the general policy type of problem. This involves such questions as whether to emphasize assistance to commercial producing farms, or to subsistence-type farms as well; and whether to concentrate on improving farm income or on achieving the maximum possible soil-conservation effect. Another type of problem related to administrative procedure. This type includes such matters as the determination of bases, goals, and conditions and rates of payment; the degree of responsibility which should be placed upon local and county committeemen; and relationships with other governmental programs.

The experimental programs tried to lay increased emphasis on the democratic aspects of the conservation program. Provisions of the special programs were often suggested and developed by county committeemen, county planning committees, county agricultural extension agents, and individual farmers. Features of the program frequently were proposed and worked out by State agricultural conservation officials or specialists from the State agricultural colleges. Sometimes, other features were proposed by Washington officials.

In all cases the special programs were laid before the farmers of the counties concerned, and farmers voted in referendums on whether

they would adopt the special program or continue with the regional programs already announced.

Of 13 special programs proposed, 9 were adopted and carried out in 1937 in 10 different counties, representing 9 different type-of-farming areas.

These programs were set up in the following counties:

Weber and Davis Counties, Utah, representing the irrigated intermountain type-of-farming area.

Pondera County, Mont., representing the less extensive wheat-growing area of the northern Great Plains.

Tama County, Iowa, representing the livestock farming enterprise of the Corn Belt.

Pulaski County, Ark., representing the level delta and rolling Cotton Belt with small farms predominating.

Kemper County, Miss., representing the hilly eastern Cotton Belt country.

White and Johnson Counties, Tenn., representing the self-sustaining and general farming sections of the eastern Appalachian area.

Guilford County, N. C., representing the general farming section of the Upper Piedmont.

Kent County, Md., representing the general farming area of the Middle Atlantic States.

Of the programs developed but not adopted in 1937, some were rejected by the Agricultural Adjustment Administration as not being in line with the provisions and purposes of the national conservation program; some were studied but not recommended by the State conservation committees; and one was voted down in the referendum among farmers, as not offering any advantages over the regional program for their county.

RESULTS OF THE 1937 PROGRAMS

Results of the special programs, and comparison of these results with the results of the regional programs in the same areas, were a matter not only of statistical calculation, but of general observation of the effectiveness, adaptability, and acceptability of the programs.

In Weber and Davis Counties, Utah, the special programs followed the provisions of the regional program very closely except that in addition to the other soil-building practices by which farmers were able to obtain payments, farmers in these regions were able to earn payments by making more efficient use of the irrigating water applied to their land. This use was classified as a soil-building practice. In these counties 125 farmers adopted the special practice and recommended its continuance for another year.

The Pondera County, Mont., program made diversion of acreage from soil-depleting crops an optional soil-building practice, paid for on that basis. Rates of payment for soil-building practices in this county were higher than those under the regional program. Simplicity of operation and emphasis on the increase in soil-conserving crops were the principal objectives of the county program. In Pondera County there were large increases in acreages of legumes, grasses, and summer fallow in 1937 as well as large diversions from

soil-depleting crops. Statistical evidence of the extent to which these results were dependent upon the county program is not available.

In Tama County, Iowa, the special program provided for farm goals and bases calculated according to the needs of the individual farm rather than on historical land-use bases. Payments were based largely on the increases in soil-conserving crops. Emphasis was laid on the objectives of soil-conservation and soil-building on individual farms where soil conditions were worse than on the average. This procedure placed heavier responsibility on county and local committeemen than did the procedure under the regular regional program. Specific internal results in Tama County were greater than in counties under the regional program, even with smaller average farm payments, in regard to controlling the acreage of corn and of all depleting crops, and in inducing the growing of conserving crops on all farms in the county. The program was participated in by a larger proportion of farmers than was the regional program in similar counties.

In Pulaski County, Ark., and Kemper County, Miss., the program laid special weight upon reduction in the acreage of cotton. Importance of soil-building practices was also stressed, and less emphasis was placed upon the use of land on the farm in crops other than cotton. The simplicity of the program as carried out in Pulaski County constituted its major advantage, results being similar to those obtained under the regional program. The Kemper County program was at least as successful as the regional program.

On the predominantly small general farms in Johnson County and the subsistence farms in White County, Tenn., soil-conservation practices and income maintenance were stressed rather than diversion from soil-depleting crops. In some respects the programs in these counties showed better results than did the regional program.

In Guilford County, N. C., and Kent County, Md., the programs were closely adjusted to individual farms. Individual bases and goals were worked out, and farms were scored on the basis of how nearly they approached the goals. The procedure showed little advantage over the provisions of the regional programs.

Among the more general and less tangible results of the special experimental county programs were the building up of good will for the adjustment program as a whole, the accomplishment of a greater degree of education among farmers with regard to the adjustment programs, the establishment of a greater confidence in the democratic procedure followed in the programs, and the development of some specific policies and administrative methods useful in the formulation of regional programs.

THE 1938 PROGRAMS

In eight States agricultural college specialists, agricultural conservation committeemen, or county groups of farmers carried on studies and developed proposals for experimental county programs. Five of the counties in which such programs were carried on in 1937—Weber, Davis, Pondera, Tama, and Pulaski—continued them in 1938. In addition experimental programs were carried on in Upshur County, W. Va.; Licking County, Ohio; Thomas County, Kans.; Jones County, S. Dak.; and Meagher County, Mont.

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The Upshur County program emphasized the adoption of soil-building practices, particularly on pasture land. The Licking County program graded performance in terms of crops grown and land treatment, specifically recognizing erosion in determining performance. The Thomas County program modified the regional method of payment in order to obtain adequate adjustments in wheat and other soil-depleting crops and to encourage adoption of special soil-building practices suited to the needs of the wind-eroding soils of the hard-winter-wheat area.

In Jones County, S. Dak., and Meagher County, Mont., the programs provide for continuance over a 3-year period and deal with range allowance and stress the limited grazing principle in range conservation rather than the deferred grazing principle.

VIII. MARKETING AGREEMENTS, LICENSES, AND ORDERS

The activities described in the foregoing pages—the agricultural conservation, range, and sugar programs—may be said to comprise one main group of operations of the Agricultural Adjustment Administration.

A second main group consists of marketing agreements, licenses, and orders. This second group also includes purchases of surplus commodities for relief distribution, and diversion of surpluses to industrial uses and export.

Marketing agreements, enforceable when necessary by licenses or orders, have become steadily more important in the Agricultural Adjustment Administration farm program. One reason for their growing use has been their availability to producers of products such as dairy products, fruits, vegetables, and nuts, which have been less affected than the basic commodities by the adjustment or conservation programs. In order to understand these activities clearly, it seems advisable to describe their background briefly.

Provisions were made in the original Agricultural Adjustment Act for the issuance of marketing agreements and licenses. The agreements were to be voluntary contracts between handlers or processors of agricultural commodities and the Secretary of Agriculture. The licenses were to be regulations issued by the Secretary of Agriculture, and effective upon handlers or processors.

These marketing agreement and license provisions were originally proposed for application only to basic commodities, as an alternative approach to production control. Recognizing an opportunity to use these powers to strengthen and make more effective their efforts in the field of marketing, representatives of farmers' cooperative organizations moved to broaden the proposed form of the marketing agreement and license provisions of the legislation. As finally enacted in 1933, the Agricultural Adjustment Act authorized marketing agreements and licenses for any agricultural commodity or product whenever it seemed clear that such marketing programs would effectuate the declared policy of the act.

These provisions were covered in only four short paragraphs which were general in nature. They did not specify the essential provisions to be included in marketing agreement programs, except as

they authorized the issuance of licenses to eliminate unfair practices or charges which prevented or tended to prevent the restoration of normal marketing conditions.

In developing plans for agriculture under these marketing provisions, the Administration had few guides other than the experiences of some industry groups in the operation of voluntary clearing houses or industry-pooling arrangements for handling surpluses through supply regulations, and the experiences of large-scale cooperative organizations in similar endeavors.

The plans incorporated in the agreement programs were based on this limited experience. They were designed to fit the commodities and areas involved and the marketing structure of the industry, and as closely as they could to effectuate the general objectives set forth in the Agricultural Adjustment Act. Provision was also made for administration of the programs through industry committees.

The immediate purpose of the agreements and licenses was to improve returns to producers. The method was to try to prevent collapse of prices of farm products by elimination of acute glutting of markets. This was done by providing for limits, in time of crowded markets, of products sold in commercial outlets or by segregating surpluses through pooling arrangements on an industry basis. In some programs, provision was made for the establishment of minimum prices.

The marketing agreement provisions of the original Agricultural Adjustment Act were greatly modified in the amendments that were adopted by Congress in 1935 after prolonged consideration. The new legislation assured that marketing agreements would not only continue as an important means of helping in the orderly distribution of farm products but would be expanded from the beginnings that had been made. The amendments continued in effect the existing marketing agreements and licenses.

In addition the amendments provided for orders instead of licenses for the future, and specified the terms and conditions which could be included in such orders. An order, like a license, is an instrument of regulation, but where the license was enforced by revocation by the Secretary, the order is enforced through an action instituted in the courts. The authority for issuing orders was limited to milk, fruits (except apples), vegetables, pecans, walnuts, soybeans, and naval stores, and the products thereof, except the products of naval stores. The amendments also provided that with the exception of olives and asparagus, orders could not be issued for fruits or vegetables for canning.

Under the amended act, responsibility for initiating a program was placed largely in the hands of the respective industries concerned, by specific provisions relating to growers' approval and signature by handlers. These required that no order could go into effect unless favored by two-thirds of the producers by number or by volume of the commodity produced in the area concerned.

For commodities other than dairy products, orders could be issued to supplement marketing agreements signed by handlers of not less than 50 percent of the volume of the commodity produced or marketed. An order would also be issued to make effective a program that was included in the marketing agreement on which a public

hearing has been held, but which failed to receive the signature of the necessary percentage of handlers concerned. The amendments required that in this situation, where 50 percent of the handlers do not sign the agreement, Presidential approval of issuance of the order as well as the support of two-thirds of the producers would be necessary.

For milk, a marketing agreement must be signed by handlers. If an order is issued with an agreement, the agreement must have been signed by handlers of at least 50 percent of the volume in the marketing area. But if handlers of 50 percent of the volume of milk in the marketing area do not sign the agreement, orders may be put into effect with the approval of the President only after findings by the Secretary as follows:

1. That issuance of the order is favored by the required two-thirds of milk producers by number or volume;
2. That noncompliance of the handlers would tend to prevent achieving the purpose of the Agricultural Adjustment Act; and
3. That such action is the only practical means to advance the interests of the producers.

The requirements that an order could be issued only if two-thirds of the producers favored it brought about an important shift in administrative policies governing the development of marketing agreement programs. Producers and their representatives became more important in shaping the programs.

Administration of these programs thus became of greater concern to producers. Industry committees were replaced by administrative committees dominated by producer interests. Since the law no longer permitted the Secretary of Agriculture to delegate such authority, these administrative committees were given authority in the law to recommend to the Secretary the issuance of regulations governing operations under a marketing agreement program.

A conflict of opinion among several Federal district courts as to the separateness of the marketing agreement provisions from the production-control provisions of the Agricultural Adjustment Act arose early in 1936 after the Supreme Court in the Hoosac Mills case had held unconstitutional the production-control and processing-tax provisions of the Agricultural Adjustment Act. In an effort to clear up all doubt about the legal status of the marketing agreement programs, and assure that their continuance would not be jeopardized by the Hoosac Mills decision, Congress passed the Agricultural Marketing Agreement Act of 1937. This law reenacts and amends the marketing agreement and order provisions of the Agricultural Adjustment Act. This was done in separate legislation, thus removing the technical questions which attorneys for processors raised in the courts soon after the Supreme Court's decision on production control and processing taxes in the Hoosac Mills case.

Today there are in effect under the Agricultural Marketing Agreement Act of 1937 programs for fruits and vegetables affecting over 300,000 growers, and programs in the dairy industry affecting nearly 1,200,000 milk producers. Producers have taken the lead in the development and operation of marketing agreement programs. In contrast, some types of handlers have grown reluctant to become parties to marketing agreements. The fact that a marketing agreement pro-

gram seeks to improve conditions for producers should not and does not in the opinion of the Agricultural Adjustment Administration imply that it will work hardships on handlers. The act provides for equitable treatment of handlers, and from a practical operating standpoint such treatment must be assured if marketing agreement programs are to be lasting and achieve their objectives.

Two general types of programs are provided for in the Marketing Agreement Act—one type for general crops (chiefly fruits and vegetables) and another for milk and its products. The law contains specific provisions governing regulations which may be issued under each type of program.

PROGRAMS FOR GENERAL CROPS

Marketing agreement programs provide for the regulation of shipments from producing areas to markets in the current of interstate or foreign commerce or directly affecting such commerce. These regulations, issued by the Secretary on the recommendations of industry committees administering the programs, are designed to adjust supplies more nearly in line with market conditions. Supplies moving to markets may be regulated either on the basis of volume or on the basis of grades and sizes shipped. These regulations may be put into effect separately or in combination.

Through these measures, alternate periods of glut and scarcity may be prevented and speculative risks minimized. These contributions which a marketing agreement program can make represent a big advance in the direction of reducing marketing costs. As a result, prices in terminal markets tend to follow a more even path, without the wide fluctuations which create doubt and encourage speculation. The long-time benefits which accrue to farmers and consumers as well as to handlers when produce moves to markets on a more orderly and less speculative basis should be obvious. Greater stability of both supply and price serves the interests of all three groups. In addition, the increased stability of supply and price factors may encourage a greater total quantity of produce to move to markets and into consuming channels, with benefit to consumers and producers, and handlers as well.

Prior to 1937 programs for fruits and vegetables were in effect through both marketing agreements and orders, and in most cases the agreements were signed by handlers representing considerably more than the 50 percent of the volume of the commodity involved. In 1937, the first orders without marketing agreements in the fruit and vegetable field were issued for potatoes. These orders were issued to regulate the grade and size of potatoes shipped out of producing areas in the States of Michigan, Wisconsin, Minnesota, North Dakota, Colorado, Nebraska, Wyoming, and Idaho, after growers had voiced their approval and handlers had indicated their refusal to sign the agreements. This action was made necessary by a critical situation which confronted potato growers because of an unusually heavy crop and extremely low prices.

During the period from May 12, 1933, when the original Agricultural Adjustment Act was approved, until June 30, 1938, programs utilizing marketing agreements, licenses, or orders were made effective for a wide variety of general crops. These programs, ef-

fective within the above period and as of July 1, 1938, classified according to types of commodities are listed as follows:

Marketing Agreement Programs.—

PROGRAMS IN EFFECT JULY 1, 1938

Pacific Coast Walnuts.
California-Arizona Citrus.
Western Washington Vegetables (lettuce, peas, and cauliflower).
Southeastern Watermelons.
Colorado Vegetables (peas and cauliflower).
Utah Onions.
Texas Citrus.
Oregon Cauliflower.
Potatoes—Idaho.
Potatoes—Michigan, Wisconsin, Minnesota, and North Dakota.
Potatoes—Colorado, Nebraska, and Wyoming.
Florida Celery.
Potatoes—Alabama, Florida, Louisiana, Mississippi, and Texas.
California and Arizona Cantaloupes.
Package Bees and Queens.
Connecticut Valley Shade Grown Tobacco.

OTHER PROGRAMS EFFECTIVE PRIOR TO JULY 1, 1938

California Canning Asparagus.
California Ripe Olives.
California Clingstone Peaches.
California Dates.
California Dried Prunes.
California Raisins.
California Gravenstein Apples.
California Fresh Asparagus.
Florida Citrus Fruits.
California Tokay Grapes.
Colorado Peaches.
Southeastern Potatoes.
Florida Strawberries.
California Fresh Deciduous Tree Fruits.
Northwest Fresh Deciduous Tree Fruits.
Turpentine and Rosin.

Nearly all of the general crop programs apply to commodities of a single area within which production is highly localized and specialized. Also, most of the producing areas covered by these programs are located at considerable distances from the principal consuming centers. Furthermore, most of the commodities included in these programs are highly perishable and many of them are perennial crops.

Largely because of these conditions, returns to producers are particularly susceptible to severe maladjustments in production and extreme fluctuation in current market supplies. Likewise, the demand for many of these commodities is subject to radical changes from year to year because of variations of supplies, competing commodities, and abrupt changes within the season due to changes in weather.

The net result of these forces has been widely fluctuating prices to both producers and consumers, periods of market gluts followed by periods of scarcity, and losses on consignment shipments with large supplies going unharvested or otherwise wasted. The serious market gluts have resulted in many producers finding little or no market for their products, in the accumulation of burdensome carryovers of the less perishable commodities, and in general dissatisfaction among farmers and losses to them and to consumers and handlers. These results have been particularly adverse during depression.

THE PROGRAM FOR THE DAIRY INDUSTRY

Besides the Agricultural Conservation Program, which has been especially useful to dairymen, and the Ever-Normal Granary, which is helping to stabilize feed corn supplies, direct assistance has been

given the dairy industry through the marketing agreements and other provisions in the act. These plans for the dairy industry have involved (1) the issuance of marketing agreements, licenses, and orders regulating the handling of milk in interstate commerce, (2) the issuance of a marketing agreement and license for the evaporated milk industry and a marketing agreement for the dry skim milk industry, (3) removal of surplus dairy products from the normal channels of trade and distribution to persons on relief, and (4) elimination of diseased dairy cattle.

Only the programs under the first, second, and fourth of these activities are outlined in the pages immediately following. An account of the purchases of surplus dairy products for relief distribution is included in the following general section on surplus removal.

Agreements, licenses, and orders for fluid milk.—The legal basis for a Federal program pointed toward the regulation of fluid milk marketing processes first was contained in section 8 of the Agricultural Adjustment Act of 1933. Although broad powers were given to the Secretary under these provisions, the powers were vague in that no specific line of action or outline of specific provisions to be included in the licenses was set forth.

Soon after the act was passed, however, proposals for definite programs for the dairy industry were presented to the Administration by the representatives of the industry. In the main these proposals differed from those for other commodities in that they omitted any direct production-adjustment features. Price-fixing and fair trade practice provisions incorporated in a marketing agreement were the principal items in all of the proposals. Other provisions were generally an outline of the customary marketing and bargaining practices in each dairy industry. These proposals became the basis of the program in 1933.

Specifically, the fluid-milk industry proposed that marketing agreements and licenses be issued for each fluid-milk market. The agreements and licenses were to provide for quite rigid regulation of market prices and trade practices. In general, the proposed agreements and licenses provided for (1) the classification and pricing of milk according to the use made of it by distributors, (2) a method for prorating to producers the proceeds of sales to distributors, involving some form of pooling, and (3) a rather complete schedule of resale prices to be charged by distributors.

Because the proposed marketing agreements and licenses did appear to meet the pertinent problems, 15 marketing agreements and licenses for fluid milk such as those described above, and marketing agreements for the evaporated-milk industry and the dry skim-milk industry, were issued in 1933.

Difficulties in the enforcement of the fluid-milk agreements and licenses were immediately encountered, especially with respect to the resale provisions. In January 1934 the Federal Government adopted a policy of issuing licenses which contained no provisions for the fixing of resale prices. Prices to producers were to be fixed at a reasonable level pointed toward stabilizing the producer price structure and effectuating the policy of the act relative to returns to producers; the other provisions of the licenses were to remain largely the same as those embodied in the agreements which they supplanted. On the whole, the policy adopted in 1934 is still being followed.

As was the case in the early marketing agreements and licenses, enforcement of the licenses which were issued pursuant to the policy established in January 1934 was exceedingly difficult. This difficulty was caused by the uncertain legal status of the program, which has been one of the major difficulties encountered in Federal regulation of milk marketing and was one of the major reasons for the decline in regulatory activity during 1935. Under the 1934 policy, licenses were issued for some 52 markets, but enforcement difficulties, adverse court decisions, etc., led to withdrawal from a number of these markets.

The increasing uncertainty as to the attitude of the courts relative to marketing agreements and licenses for dairy producers as well as other farmers led to the amendment of the act in 1935. The amendments to the act incorporated in a great deal of detail those features of the program which had been found to be desirable as an aid in stabilizing fluid-milk markets, and set forth rather clearly the powers and duties of the Secretary relative to the regulation of fluid-milk markets.

Following the decision of the Supreme Court in the Hoosac Mills case in 1936, and the raising in the lower courts of questions as to the validity of the marketing agreement and order program, new difficulties beset the dairy marketing program. Soon after the Hoosac Mills decision, order No. 4 regulating the handling of milk in the Greater Boston marketing area, was put into effect, and enforcement troubles immediately arose. In a case involving the order in Boston, the order was held to be unconstitutional on the basis that the Supreme Court's decision in the Hoosac Mills case had invalidated the entire Agricultural Adjustment Act, including the marketing agreement provisions. This decision was later reversed by the circuit court of appeals, but before this decision was rendered by the circuit court, the Agricultural Marketing Agreement Act of 1937, reenacting and amending the marketing agreement and order provisions of the Agricultural Adjustment Act as amended in 1935, was enacted.

Since the passage of the Agricultural Marketing Agreement Act of 1937, the activity of the Federal Government in the regulation of fluid-milk markets has been expanded materially, especially in 1938.

At the present time, licenses are in effect in San Diego, Calif.; Battle Creek and Kalamazoo, Mich.; Louisville, Ky.; Denver, Colo.; New Bedford, Mass.; Wichita and Leavenworth, Kans.; Omaha-Council Bluffs, Nebr. and Iowa; Sioux City, Iowa; Lincoln, Nebr.; and Quad Cities (East Moline, Moline, and Rock Island, Ill., and Davenport, Iowa).

The decline in the number of milk markets under license (a total of 52 licenses were issued prior to the 1935 amendments to the act) represents in part a reduction in the number of markets under regulation because of a policy of regulating only those markets clearly within the scope of Federal authority, and in part a shift from licenses to orders pursuant to the amended act. In other markets, the market situation developed to the point where local groups could take full charge, and Federal activity in such markets was discontinued.

Six orders, issued under the act as amended in 1935 and under the Agricultural Marketing Agreement Act of 1937, are now in effect. These orders regulate the handling of milk in Boston, Mass.;

La Porte, Ind.; St. Louis, Mo.; Dubuque, Iowa; Kansas City, Mo.; and Fall River, Mass. Marketing agreements are in effect in Fort Wayne, Ind., and Topeka, Kans, while marketing agreements and orders are in effect in Cincinnati, Ohio, and New York City.

During 1938, material progress has been made in the regulation of the handling of milk in interstate commerce. The marketing agreement and order for Cincinnati, Ohio, was made effective May 1. The work involved in the issuance of an order for Toledo, Ohio, is nearing completion. The ground work has been laid for the issuance of an order for Philadelphia, Pa., but it appears that the troubles in this market may be rectified without the necessity of an order being issued. In connection with all activity undertaken relative to the issuance of orders, it is to be noted that such activity is undertaken only at the request of producers.

While the regulatory activity in the markets just noted represents a marked increase over that of the last 2 or 3 years, by far the greatest step in regulation of milk marketing under the act was undertaken when the New York order went into effect September 1, 1938. The New York market is the largest and perhaps the most complicated milk market in the United States, if not in the world, and the issuance of the order for this market is the result of over a year's work with producers in that market. This agreement had been in effect only a brief time when this report was written and its operations cannot be detailed in this report.

Although the program for Federal regulation of the interstate commerce of milk in fluid-milk markets was still beset by legal difficulties, progress was being made in the enforcement of orders at the time this report was prepared. The Federal Government had been successful in securing temporary injunctions against 31 handlers in Boston who were in violation of the order. The circuit court of appeals had upheld this injunction but had granted the handlers the privilege of paying the moneys ordered to be paid to the market administrator under the order and under the temporary injunction of the Federal district court into the district court pending trial of the cases on their merits.

Starting in January 1938 hearings on a permanent injunction were begun before a special master appointed by the Federal district court. These hearings were concluded in May, and at the writing of this report the preparation of the findings of the master was being completed. Undoubtedly the material increase in activity relative to the issuance of orders could be largely attributed to the success of the Government in litigation involving orders issued under the Agricultural Marketing Agreement Act of 1937.

Marketing agreements and licenses for manufactured dairy products.—The intention of the Administration to develop marketing agreements for dairy products other than fluid milk made a beginning during 1933. A marketing agreement was issued for the evaporated milk industry, which accounts for about 4 percent of all milk produced, and one for the dry skim milk industry. The proposals for marketing agreements for butter, cheese, and ice cream, accounting for over 40 percent of all milk produced, were never made effective.

Soon after the act was passed, producers and manufacturers of evaporated milk requested Government aid under the marketing agreement and license provisions of the act. An agreement was finally worked out and made effective September 9, 1933. It was signed by all manufacturers except three small firms.

This agreement provided for (1) the fixing of minimum prices to producers on a formula basis, which varied slightly for different sections of the country, with butter mainly constituting the basis of prices, (2) the fixing of maximum and minimum prices which manufacturers were allowed to charge wholesale distributors and commissaries, and (3) the establishment of a set of trade practice rules, such rules being pointed primarily to the elimination of any kind of discount or rebate for advertising allowances.

While this agreement appears to have increased prices to producers, considerable opposition soon developed in connection with the fixing of manufacturers' selling prices. In addition, the smaller manufacturers were of the opinion that the manufacturers' committee, which was set up to administer the terms of the agreement, was partial to large distributors and did not give enough consideration to the problems of small manufacturers.

The Marketing Agreement for Dry Skim Milk was made effective on September 16, 1933. Rather than acting directly to increase farm income by establishing producer prices as was the policy for fluid milk and evaporated milk, this agreement was designed to increase farm income by establishing an open-price plan which required that all signing parties inform the managing agent (the official selected to administer the program), who in turn informed the other manufacturers, of all price changes that were to be made. To give these filed prices some meaning many regulations covering the methods of sale, basis of price quotation, and other important trading practices were incorporated in the agreement. All sales by a manufacturer had to be made at the current price which he had filed with the managing agent.

Little difficulty was experienced in the operations of these two agreements in 1934. The evaporated-milk agreement was not amended or changed during 1934. The dry skim-milk agreement was amended only slightly, principally to simplify certain classification provisions, to lower discounts, and to clarify the status of the users of the dry skim milk in the feed industry who had been reselling the dry milk at lower prices than those at which the manufacturers were allowed to sell.

Since 1934 marketing agreement and license activity relative to manufactured dairy products has centered mainly around the evaporated-milk agreement.

Increasing difficulties, arising principally from the schedule of manufacturers' selling prices, which were fixed in the evaporated milk agreement, led to a revision of the agreement in June 1935. This revised agreement eliminated the schedule of fixed manufacturers' selling prices, continued the fixing of producers' prices on a formula basis, six pricing regions being specified in this connection, and granted some increase in the authority of the producers' committee. Also, the representation of the small manufacturers on the manufacturers' committee was increased.

Inasmuch as many of the manufacturers did not sign the new agreement, the industry was licensed. However, the most important change in the agreement was the development of the system of price filing by manufacturers to take the place of the fixed schedule of manufacturers' selling prices set forth in the previous agreement.

Since the issuance of the agreement and license in June 1935, the industry appears to have worked fairly satisfactorily. In many cases the prices paid producers in the several producer-price zones have been materially above the minimum prices established by the formula.

OTHER DAIRY PROGRAMS

Congress on April 7, 1934, in section 6 of the Jones-Connally Cattle Act, authorized the appropriation of $50,000,000 to enable the Secretary of Agriculture to take steps to eliminate diseased dairy and beef cattle, including those affected with tuberculosis and Bang's disease, and for other purposes. In order to continue the program, and for other purposes, Congress in 1935 reappropriated the unexpended balance of the funds appropriated in section 6 of the Jones-Connally Cattle Act and authorized the appropriation of an additional $40,000,000, of which amount $10,000,000 was appropriated. On June 4, 1936, Congress reappropriated $21,364,000 from any unobligated balances of the appropriation made for cattle disease elimination and continued their availability, together with any unexpended balance of the $10,000,000 previously appropriated pursuant to section 37. On June 29, 1937, Congress reappropriated $15,864,000 from any unobligated balance of the $21,364,000 made available for the fiscal year 1937, together with any unobligated balances remaining in section 37 funds. These funds remained available until June 30, 1938.

Eradication of bovine tuberculosis.—Before the tuberculosis work was expanded through the appropriation of additional funds there were 13 States modified accredited for tuberculosis.[3] After over 3 years of expanded activity in this work there are now only two States that are not modified accredited.

During the period July 1934 to May 1, 1938, there were 73,447,530 tuberculin tests applied to cattle in 6,174,512 herds, and 713,105 reactors were eliminated. (See table 5.) The percentage of reactors among cattle tested in the month of April 1938 amounted to 0.7 percent, whereas the percentage in July 1934 amounted to 2.9. The additional expenditures, first authorized by the Jones-Connally Cattle Act, have extended over a period of 3 years and 10 months and have amounted to approximately $19,552,646.

Eradication of Bang's disease.—Although no large scale efforts to eradicate Bang's disease had been attempted prior to the program initiated in July 1934, the work has met with enthusiastic approval by the majority of the livestock owners throughout the country. The program has always been conducted on a voluntary basis in cooperation with livestock owners and State authorities. In addition to a Federal payment received by the owners of cattle reacting to the Bang's test, there are now 12 States which make additional State payments to the owners.

[3] States that have not more than one-half of 1 percent of their total cattle population infected with the disease.

During the period July 1934, to May 1, 1938, there were 24,436,841 tests applied to cattle in 1,855,195 herds and 1,501,141 Bang's reactors were eliminated. (See table 6.) The percentage of reactors among cattle tested has steadily declined from 14.9 percent in 1934 to 4 percent in the month of April 1938. Approximately $47,910,790 have been expended for operating costs and indemnity payments during the 3 years and 10 months the program has been in effect.

As was the case in the eradication of bovine tuberculosis, the work in connection with the Bang's disease program is progressing along the lines of area testing. An area consists of a county or parish, and all breeding cattle 6 months of age and over are repeatedly tested until the disease has been eradicated. Area work is now being conducted in 290 counties or parishes of 22 States, with an additional 50 counties on the waiting list.

TABLE 5.—*Tuberculin testing under the Federal-State county program and the Jones-Connally Cattle Act showing only expenditures of funds provided under the Jones-Connally Cattle Act and subsequent acts, July 1934 to July 1, 1938*

State	Tests applied to—		Reactors	Percent reactors are of total tests applied to cattle	Expenditures		
	Herds	Cattle			Operating	Indemnity	Total operating and indemnity
	Number	*Number*	*Number*	*Percent*	*Dollars*	*Dollars*	*Dollars*
Maine	37,869	307,847	535	0.17	6,889	0	6,889
New Hampshire	59,738	534,590	1,334	.25	0	11,281	11,281
Vermont	72,633	1,291,658	8,083	.63	72,705	183,719	256,424
Massachusetts	114,928	1,016,087	13,172	1.30	25,528	28,520	54,048
Rhode Island	14,919	144,463	5,187	3.59	3,152	2,168	5,320
Connecticut	70,738	810,476	14,647	1.81	0	275,390	275,390
New York	535,230	7,893,031	189,129	2.40	357,722	4,041,386	4,399,108
New Jersey	79,266	952,601	8,023	.84	240	15,588	15,828
Pennsylvania	292,778	2,759,975	36,400	1.32	108,692	44,615	153,307
NORTH ATLANTIC	1,278,099	15,710,728	276,510	1.76	574,928	4,602,667	5,177,595
Ohio	284,086	2,225,189	5,848	.26	160,441	80,612	241,053
Indiana	65,693	818,503	3,219	.39	26,277	8,122	34,399
Illinois	416,880	4,552,189	19,505	.43	0	14,671	14,671
Michigan	211,455	1,840,465	2,272	.12	0	0	0
Wisconsin	205,803	3,825,753	9,077	.24	152,874	218,089	370,963
EAST NORTH CENTRAL	1,183,917	13,262,099	39,921	.30	339,592	321,494	661,086
Minnesota	256,470	3,347,262	9,411	.28	153,310	170,692	324,002
Iowa	353,997	6,443,140	49,849	.77	240,224	546,322	786,546
Missouri	192,087	1,502,850	1,502	.10	317,770	34,890	352,660
North Dakota	40,358	702,028	3,175	.45	49,360	63,459	112,819
South Dakota	156,816	3,166,763	32,772	1.03	775,518	706,094	1,481,612
Nebraska	151,652	3,470,996	17,234	.50	582,557	374,315	956,872
Kansas	70,783	965,965	5,831	.60	160,705	114,293	274,998
WEST NORTH CENTRAL	1,222,163	19,599,004	119,774	.61	2,279,444	2,010,065	4,289,509
Delaware	13,788	168,425	1,012	.60	678	600	1,278
Maryland	68,537	800,468	3,695	.46	39,736	4,584	44,320
District of Columbia	37	2,778	0		79,582	0	79,582
Virginia	30,225	334,255	1,374	.41	15,893	11,797	27,690
West Virginia	13,498	129,169	221	.17	17,139	1,271	18,410
North Carolina	6,788	115,548	95	.08	0	0	0
South Carolina	24,426	114,878	11	.01	14,666	0	14,666
Georgia	104,959	861,805	243	.03	145,142	5,227	150,369
Florida	26,107	501,379	789	.16	40,825	13,664	54,489
SOUTH ATLANTIC	288,365	3,028,705	7,440	.25	353,661	37,143	390,804

TABLE 5.—*Tuberculin testing under the Federal-State county program and the Jones-Connally Cattle Act showing only expenditures of funds provided under the Jones-Connally Cattle Act and subsequent acts, July 1934 to July 1, 1938*—Continued

State	Tests applied to—		Reactors	Percent reactors are of total tests applied to cattle	Expenditures		
	Herds	Cattle			Operating	Indemnity	Total operating and indemnity
	Number	*Number*	*Number*	*Percent*	*Dollars*	*Dollars*	*Dollars*
Kentucky	14,578	227,985	341	.15	0	86	86
Tennessee	86,750	404,170	535	.13	118,463	8,991	127,454
Alabama	191,441	1,067,298	1,566	.15	206,263	27,756	234,019
Mississippi	235,457	1,378,618	1,604	.12	344,055	35,164	379,219
Arkansas	219,184	1,174,010	675	.06	112,517	10,976	123,493
Louisiana	152,234	1,656,156	2,771	.17	214,019	52,842	266,861
Oklahoma	264,968	2,817,981	5,142	.18	397,993	103,933	501,926
Texas	509,214	4,064,123	1,849	.05	878,905	22,072	900,977
SOUTH CENTRAL	1,673,826	12,790,341	14,483	.11	2,272,215	261,820	2,534,035
Montana	29,262	625,826	667	.11	131,227	7,542	138,769
Idaho	11,239	111,285	274	.25	5,798	588	6,386
Wyoming	19,290	572,424	1,534	.27	146,087	17,885	163,972
Colorado	65,543	1,311,324	9,391	.72	250,101	166,400	416,501
New Mexico	23,550	226,001	426	.19	58,756	1,247	60,003
Arizona	22,755	477,787	1,097	.23	93,588	23,637	117,225
Utah	27,632	141,967	789	.56	9,116	0	9,116
Nevada	3,787	86,162	117	.14	7,670	0	7,670
Washington	81,190	803,913	4,755	.59	92,185	43,154	135,339
Oregon	48,172	366,046	1,845	.50	3,283	19,650	22,933
California	223,041	5,109,461	240,849	4.71	1,009,731	4,385,552	5,395,283
WESTERN	555,461	9,832,196	261,744	2.66	1,807,542	4,665,655	6,473,197
Puerto Rico	61,317	611,273	3,605	.59	100,218	86,460	186,678
Hawaii	1,461	52,902	269	.51	0	0	0
Virgin Islands	424	11,351	0		1,853	0	1,853
Interstate	83,435	939,584	1,541	.16	0	0	0
Total	6,348,468	75,838,183	725,287	.96	7,729,453	11,985,304	19,714,759

TABLE 6.—*Summary of Bang's disease testing and summary of expenditures, July 1934 to July 1, 1938*

State	Tests applied to—		Reactors	Percent reactors are of total tests applied to cattle	Expenditures		
	Herds	Cattle			Operating	Indemnity	Total operating and indemnity
	Number	*Number*	*Number*	*Percent*	*Dollars*	*Dollars*	*Dollars*
Maine	6,685	105,834	7,115	6.72	62,394	208,800	271,194
New Hampshire	6,665	93,831	6,330	6.75	21,300	194,511	215,811
Vermont	2,247	70,141	4,347	6.20	22,146	126,776	148,922
Massachusetts	560	18,752	1,131	6.03	2,175	42,000	44,175
Rhode Island	298	11,557	721	6.24	97	19,820	19,917
Connecticut	1,413	45,818	2,809	6.13	9,559	88,652	98,211
New York	13,493	350,696	22,132	6.31	149,294	707,367	856,661
New Jersey	2,195	143,788	3,944	2.74	6,567	127,549	134,116
Pennsylvania	70,622	980,056	49,634	5.06	252,279	1,431,599	1,683,878
NORTH ATLANTIC	104,178	1,820,473	98,163	5.39	525,811	2,947,074	3,472,885
Ohio	74,490	806,008	61,620	7.65	289,418	1,733,162	2,022,580
Indiana	48,079	593,253	41,065	6.92	239,713	1,100,969	1,340,682
Illinois	25,016	405,208	40,747	10.06	191,124	1,097,405	1,288,529
Michigan	68,469	756,554	36,694	4.85	252,862	1,002,903	1,255,765
Wisconsin	173,118	3,241,775	200,772	6.19	834,712	5,080,410	5,915,122
EAST NORTH CENTRAL	389,172	5,820,473	380,898	6.54	1,807,829	10,014,849	11,822,678

TABLE 6.—*Summary of Bang's disease testing and summary of expenditures, July 1934 to July 1, 1938*—Continued

State	Tests applied to—		Reactors	Percent reactors are of total tests applied to cattle	Expenditures		
	Herds	Cattle			Operating	Indemnity	Total operating and indemnity
	Number	*Number*	*Number*	*Percent*	*Dollars*	*Dollars*	*Dollars*
Minnesota	116,240	1,854,468	127,016	6.85	617,557	3,204,015	3,821,572
Iowa	37,315	655,437	74,892	11.43	269,081	1,986,662	2,255,743
Missouri	108,375	1,257,331	80,877	6.43	510,171	2,052.707	2,562,878
North Dakota	17,252	291,072	17,000	5.84	109,459	443,615	553,073
South Dakota	3,954	95,084	9,105	9.58	51,328	239,625	290.953
Nebraska	12,163	244,778	19,782	8.08	111,657	561,551	673,208
Kansas	14,459	401,269	44,193	11.01	170,560	1,232,103	1,402,663
WEST NORTH CENTRAL	309,758	4,799,439	372,865	7.77	1,839,813	9,720,278	11,560,091
Delaware	6,306	62,522	3,982	6.37	12,292	91,360	103,652
Maryland	26,819	254,136	15,390	6.06	148,098	437,078	585.176
District of Columbia	0	0	0	0	[1] 1,452,478	0	[1] 1,452,478
Virginia	233,758	1,248,473	33,805	2.71	534,784	894,739	1,429,523
West Virginia	58,365	381,430	10,333	2.71	159,896	255,726	415,622
North Carolina	49,425	387,250	13,597	3.51	69,683	360,224	429,907
South Carolina	12,513	197,094	6,464	3.28	102,250	151,671	253,921
Georgia	27,972	392,625	16,717	4.26	112,829	416,617	529,446
Florida	29,656	734,981	40,640	5.53	189,485	1,013,241	1,202,726
SOUTH ATLANTIC	444,814	3,658,511	140,928	3.85	2,781,795	3,620,656	6,402,451
Kentucky	49,349	521,183	32,996	6.33	225,649	855,629	1,081,278
Tennessee	33,933	499,073	34,674	6.95	192,695	963,105	1,155,800
Alabama	39,376	890,948	40,249	4.52	293.626	988,921	1,282,547
Mississippi	16,275	326,663	18,703	5.73	127,793	430,250	558,043
Arkansas	122,697	758,288	28,224	3.72	376,487	638,807	1,015,294
Louisiana	96,165	675,278	39,229	5.81	254,027	804,781	1,058,808
Oklahoma	78,969	1,563,571	103,893	6.64	486,794	2,447,159	2,933,953
Texas	20,743	1,051,639	66,055	6.28	240,170	1,658,360	1,898,530
SOUTH CENTRAL	457,507	6,286,643	364,023	5.79	2,197,241	8,878,012	10,934,253
Montana	16,672	364,582	22,497	6.17	104,675	580.632	685,307
Idaho	31,406	366.953	24,158	6.58	161,154	584,172	745.326
Wyoming	3,619	167,941	10,745	6.40	85,855	255,185	341,040
Colorado	1,570	68,249	3,426	5.02	13,501	95,854	109,355
New Mexico	11,758	164,075	5,744	3.50	96,108	133,751	229,859
Arizona	3,633	82,289	3,233	3.93	38,619	86,352	124.971
Utah	29,829	237,703	14,269	6.00	122,269	392,921	515.190
Nevada	4,032	79,919	7,452	9.32	46,040	155.629	201.669
Washington	88,437	871,270	55,521	6.37	387,419	1,401,714	1,789.133
Oregon	88,972	1,071,500	56,057	5.23	397,849	1,342,891	1,740.740
California	130	8,213	524	6.38	5,915	15,709	21,624
WESTERN	280,058	3,482,694	203,626	5.85	1,459,404	5,044,810	6,504.214
Puerto Rico	8	441	7	1.59	126	225	351
Hawaii	0	0	0	0	240	66	306
Total	1,985,495	25,850,999	1,560,510	6.04	10,612,259	40,134,970	50,747,229

[1] Includes general operating expenditures, amounting to $1,219,314 over the 4-year period, which cannot be accurately allocated among the various States.

IX. PROGRAMS FOR SURPLUS REMOVAL AND EXPANSION OF MARKETS

Programs for the removal of surpluses and expansion of markets have centered about two major types of activities. These have been purchases of surplus commodities for distribution to State relief agencies, and the diversion of price-depressing surpluses into export channels or into new or byproduct uses. The first type of program has as its major objective the use of surpluses to relieve needy people. It seeks to bridge the gap between price-breaking surpluses and

human hunger. Both types of programs seek the enhancement of agricultural income. Both serve important immediate objectives in the improved market conditions they bring about.

The A. A. A. purchase programs are carried on by the Federal Surplus Commodities Corporation. By filling relief needs with farm surpluses, they have endeavored to effect a simple and direct approach to two vexing national problems. The approach is necessarily limited in scope and offers no final solution to either the surplus or the relief problem, but it has the advantage of attacking both problems with one simple answer.

The diversion programs have played a similar dual role by developing new outlets for excess commodities while at the same time improving grades and standards for the quantities shipped to the customary outlets.

OPERATIONS OF THE FEDERAL SURPLUS COMMODITIES CORPORATION

The Federal Surplus Commodities Corporation was chartered as a nonprofit membership corporation under the laws of Delaware, October 4, 1933, as the Federal Surplus Relief Corporation. On November 18, 1935, the name was changed to its present form and the Corporation was placed under the direction of the Department of Agriculture.

From November 18, 1935, to May 6, 1938, the Corporation spent approximately $57,950,000 on purchase programs in connection with surplus agricultural products. Through these purchase programs it diverted about 56,400 carloads of such products from the normal channels of trade, and distributed 2,135,000,000 pounds of foodstuffs to persons who otherwise would not have been able to obtain them.

Before it was placed under the direction of the Department of Agriculture, the Corporation had been concerned with meeting relief needs, and only more or less incidentally with the farm end of the dual problem. Its first grants of funds were made under the law creating the Federal Emergency Relief Administration, May 12, 1933. It also distributed farm products acquired by the Secretary of Agriculture through the Agricultural Adjustment Administration and donated to the Corporation for its use. The Jones-Connally Cattle Act, approved April 7, 1934, authorized the appropriation of funds to enable the making of advances to the Federal Surplus Relief Corporation for the purchase of dairy and beef products for distribution and relief purposes.

Section 32 of Public, No. 320, 74th Congress, which also contained the amendments of 1935 to the Agricultural Adjustment Act, appropriated funds for each fiscal year equal to 30 percent of the customs receipts to the Secretary of Agriculture. Included among the purposes for which such funds might be used was the encouragement of domestic consumption of agricultural commodities or products by diverting them from the normal channels of trade. The Federal Surplus Commodities Corporation became one of the means by which surplus agricultural products could be purchased and donated to States for distribution to needy persons on relief.

Later amendments permitted the purchase of commodities, for the purposes enumerated in section 32, without requiring competitive

bids on goods bought by Government. These amendments also simplified the procedure of approving purchase programs, and authorized the allocation of funds to the Corporation so that it might make purchases direct instead of confining its activities to the relief distribution of commodities purchased through the Agricultural Adjustment Administration.

When the Corporation was placed under the direction of the Department of Agriculture in November 1935, a change in policy resulted. The objective of Corporation activities became to develop programs that would help agricultural groups faced with long-time or temporary surpluses, as well as to assist people on relief. The operation now had two important objectives. For agriculture, the purpose was to protect or increase farm income by removing burdensome surpluses of agricultural products from the regular market channels. For people on relief, the purpose was to give these commodities to persons who would otherwise go without, and thus encourage maximum utilization of the crop.

Since November 1935, about 79 percent of all expenditures were authorized under section 32 provisions. About 9 percent were authorized under the Jones-Connally Act (Public, No. 142, 74th Cong.); 7 percent were made from Federal Surplus Commodities Corporation funds: 5 percent from State funds. As used here, Corporation funds are residual balances from the financing of the activities of the Federal Surplus Relief Corporation by the Federal Emergency Relief Administration. State funds are the proceeds of the sale of commodities acquired during the drought programs of 1934 which were not suitable for relief distribution (principally wool and hides), and the funds currently derived from sales of containers which are in excess of requirements for maintaining intrastate distribution.

Table 7 shows the sources of funds and the distribution of their expenditure from November 18, 1935, to May 6, 1938.

TABLE 7.—*Distribution of expenditure for current programs by sources of funds, from Nov. 18, 1935, to May 6, 1938*

Source of funds	Nov. 18, 1935, to June 30, 1936		July 31, 1936, to June 30, 1937		July 31, 1937, to May 6, 1938		Total	
	Thousand dollars	*Percent*	*Thousand dollars*	*Percent*	*Thousand dollars*	*Percent*	*Thousand dollars*	*Percent*
Section 32	11,251	75	10,222	66	24,137	88	45,610	79
State	2,087	14	805	5	7	(1)	2,899	5
Jones-Connally	1,542	10	3,464	23	----------	--------	5,006	9
Jones-Costigan	111	1	----------	--------	----------	--------	111	(1)
Federal Surplus Commodities Corporation	----------	--------	898	6	3,363	12	4,261	7
Total	14,992	100	15,389	100	27,569	100	57,950	100

[1] Less than 0.5 percent.

Tables 8, 9, and 10 show the commodities purchased, by expenditures and by quantities, for each of the three fiscal periods into which the history of the Corporation has been divided.

In the 7½ months ended June 30, 1936, among the 22 commodities purchased the principal one was wheat, of which 3,000,000 bushels were purchased at a cost to the Corporation, including

transportation, of approximately $3,730,000. Raw cotton was second with purchases of about 50,000 bales at a total cost of $2,800,000. The third item in importance was fresh apples, of which 2,648,000 bushels were purchased at a cost of approximately $2,058,000. Prunes were fourth with purchases of 28,600,000 pounds at a cost of about $1,339,000. Butter was fifth with purchases totaling 2,951,000 pounds at a cost of $853,000. Other important commodities were cotton ticking, evaporated milk, cotton mats, cotton fabric, dried beans and peas, and onions.

TABLE 8.—*Federal Surplus Commodities Corporation expenditures, by commodities, Nov. 18, 1935, through June 30, 1936*

Commodity	Quantity purchased	Total expenditure [1]
Wheat—bushels	3,025,316	$3,729,506.69
Cotton (raw)—bales	49,997	2,799,750.36
Apples (fresh)—bushels	2,648,262	2,058,069.76
Prunes (dried)—pounds	28,591,500	1,339,173.83
Butter—do	2,951,303	852,584.36
Onions—do	32,533,280	525,839.40
Cotton Ticking—yards	4,750,041	515,790.62
Milk (evaporated)—cases	181,600	422,134.00
Cotton Mats—pieces	89,527	365,463.65
Cotton Fabric—yards	2,870,783	363,189.74
Peas (dried)—pounds	17,993,175	360,633.29
Beans (dried)—do	15,126,220	340,913.81
Oranges—boxes	198,312	299,585.36
Eggs (shell)—cases	31,472	198,604.25
Cheese—pounds	931,948	143,083.26
Grapes—do	3,188,376	134,093.48
Milk (dry skim)—do	1,593,563	124,365.10
Sugar (beet)—do	2,500,000	110,951.07
Cabbage—do	8,741,659	108,462.27
Oats (rolled)—do	3,000,000	74,701.00
Do—do	14,520,866	[2]
Oats (cereal enriched)—do	4,200,746	[2]
Grapefruit—boxes	31,480	40,430.10
Carrots—pounds	2,637,400	26,978.80
Peas (fresh)—do	642,405	24,050.17
Figs (dried)—do	600,000	22,500.00
Cherries (canned)—10 cans	30,000	10,000.00
Turnips—pounds	182,300	727.20
Total		14,991,561.77

[1] Including transportation. [2] Exchange.

TABLE 9.—*Federal Surplus Commodities Corporation expenditures, by commodities, July 1, 1936, through June 30, 1937*

Commodity	Quantity purchased	Total expenditure [1]
Grapefruit—boxes	2,126,231	$2,547,464.77
Prunes (dried)—pounds	42,939,475	2,269,846.68
Eggs (shell)—cases	287,601	2,136,765.88
Milk (dry skim)—pounds	25,190,225	1,842,619.86
Milk (evaporated)—cases	451,400	1,094,397.68
Butter—pounds	3,025,074	941,779.20
Grapefruit Juice—cases	715,070	894,119.67
Fish (frozen)—pounds	12,347,737	725,395.26
Potatoes (white)—bushels	960,556	677,369.47
Pears (fresh)—boxes	267,797	353,659.71
Onions—pounds	15,217,037	254,106.34
Peaches (dried)—do	2,940,000	251,269.20
Oat cereal (enriched)—do	5,634,902	187,193.49
Peas (dried)—do	6,599,470	158,094.82
Walnuts (English)—do	1,013,000	139,681.91
Syrup (cane)—gallons	307,385	113,951.18
Oats (rolled—pounds	3,633,300	112,515.89
Rice (milled)—do	3,999,980	101,872.72
Cattle—head	3,663	99,191.46

[1] Including transportation.

TABLE 9.—*Federal Surplus Commodities Corporation expenditures, by commodities, July 1, 1936, through June 30, 1937*—Continued

Commodity	Quantity purchased	Total expenditure [1]
Cauliflower—crates	78,670	79,048.40
Celery—do	68,980	62,906.20
Apples (dried)—pounds	750,000	60,000.00
Peas (fresh)—do	1,911,209	54,091.74
Sheep—head	14,169	43,496.28
Beans (dried)—pounds	1,300,637	40,041.78
Hogs—head	1,573	37,283.54
Cabbage—pounds	8,585,560	28,971.92
Cheese—do	138,438	24,697.55
Wheat (for flour)—bushels	14,181	20,596.34
Apples (fresh)—do	14,330	9,518.61
Figs (dried)—pounds	209,800	8,831.75
Turnips (fresh)—do	1,388,365	6,941.67
Cotton Fabric—yards	57,089	6,835.63
Beans (fresh green)—pounds	72,223	1,223.54
Tomatoes (fresh)—do	250,844	1,195.62
Beets—do	146,525	810.74
Chard (Swiss)—do	53,425	258.07
Carrots—do	35,190	257.31
Spinach—do	32,358	194.16
Corn (fresh)—do	52,560	175.50
Honey—do	2,940	147.00
Syrup (Sorghum)—gallons	200	100.00
Total		15,388,918.54

[1] Including transportation.

TABLE 10.—*Federal Surplus Commodities Corporation expenditures, by commodities, July 1, 1937, to May 6, 1938*

Commodity	Quantity purchased	Total expenditure [1]
Apples (fresh)—bushels	5,627,637	$4,472,203.54
Potatoes (white)—do	4,279,825	2,877,039.39
Butter—pounds	9,202,268	2,618,972.26
Oranges—boxes	1,661,314	2,266,043.30
Prunes (dried)—pounds	45,105,650	2,205,995.81
Rice (milled)—do	72,630,000	2,005,539.50
Beans (dried)—do	53,140,000	1,878,765.00
Eggs (shell)—cases	270,164	1,724,809.36
Peas (canned)—do	860,212	1,513,103.48
Apples (dried)—pounds	14,547,500	1,325,333.55
Cottonseed Oil (short.)—do	8,704,200	790,654.89
Milk (fluid)—quarts	8,548,176	602,646.43
Milk (dry skim)—pounds	8,642,250	520,864.80
Pears (fresh)—boxes	318,162	483,462.05
Grapes—pounds	15,830,000	329,538.66
Celery—crates	184,475	323,772.50
Apricots (dried)—pounds	3,590,000	286,970.73
Potatoes (sweet)—bushels	482,536	239,075.97
Cabbage—pounds	18,952,642	237,431.91
Grapefruit—boxes	211,902	200,817.58
Peaches (dried)—pounds	2,534,000	194,480.00
Peas (dried)—do	6,000,000	128,260.00
Tomatoes (canned)—cases	50,000	102,151.95
Potato Flour—pounds	1,761,720	84,252.60
Cotton Fabric—yards	655,997	67,090.94
Onions—pounds	3,000,000	47,510.27
Potato Starch—do	800,000	39,870.00
Watermelons—melons	13,865	598.69
Beans (fresh green)—pounds	44,970	562.12
Walnuts (English)—do	1,000	115.00
Filberts—do	500	65.00
Total		27,568,797.28

[1] Including transportation.

In the fiscal year ended June 30, 1937, purchases of 39 different commodities were made. Prunes were at the top of the list with an expenditure of $2,270,000 for 42,939,000 pounds. Eggs were second with an expenditures of $2,137,000 for 288,000 cases. Dry skim milk was third with purchases of 25,190,000 pounds at a commodity expenditure of $1,843,000. Other important commodities included grapefruit and grapefruit juice, evaporated milk, butter, frozen fish, white potatoes, dried peaches, fresh pears, and a miscellaneous list of other fruits and vegetables.

Between July 1, 1937, and May 6, 1938, 31 different commodities were purchased. Apples were the most important item. Expenditures, excluding costs of transportation, totaled $4,573,000 for fresh and dried apples, equivalent to a total of 8,013,000 bushels in the fresh form. Potatoes were second with purchases of about 4,300,000 bushels. Butter was third with commodity expenditures of $2,598,000 for 9,202,000 pounds. About 1,700,000 boxes of oranges were purchased at a cost of $2,300,000. Prunes were fifth with a total expenditure of $2,206,000 for 45,106,000 pounds. Rice purchases were sixth in importance, accounting for 72,630,000 pounds at a cost of $2,006,000. Eggs were seventh, with purchases of 270,164 cases at a cost of $1,725,000. Other important commodities were dried beans, canned peas, cottonseed oil, milk in both fluid and dry skim forms, fresh pears, dried apricots, and grapes. Purchases of each of these commodities involved commodity expenditure of more than $200,000, ranging upward to $1,600,000.

The purchases have not been a large part of the total supplies marketed. In most instances they have been from 1 to 5 percent of the total quantities available. They have been made when supplies were at or near record levels and grower returns were, or threatened to be, relatively low.

The Federal Surplus Commodities Corporation does not distribute the products it purchases directly to persons on relief, but makes them available to State welfare agencies which carry out the distribution under the supervision of the Corporation. The principal basis for the distribution of these commodities is the number of persons eligible for relief in the State concerned. Perishability of the commodities, transportation costs, and the desire to encourage new consumption of various products are other factors taken into account in the determination of the distribution.

From November 18, 1935, through June 30, 1936, a total of 591,000,000 pounds of foodstuffs was distributed, with a commercial value of approximately $41,000,000. In the fiscal year ended June 30, 1937, the total was approximately 555,000,000 pounds with a retail value of about $38,000,000. From July 1, 1937, to May 6, 1938, the volume of foodstuffs distributed increased to about 989,000,000 pounds, with a commercial value of about $67,300,000.

Purchase methods and price policy.—Since November 1935, a number of purchasing methods have been employed by the Corporation. For some commodities, especially processed commodities, the practice of calling for formal bids has been used. Under this arrangement offers are advertised, bids are submitted by those interested, the bids are then opened publicly, and awards are made to the lowest

bidder. A less formal bid method has sometimes been used, in which it may be stipulated that growers will be given first preference in any bids submitted, or that acceptance will be based not only on the lowest price but also on the price which the bidding processors agreed to pay growers.

Another method quite generally used is called the fixed price. By this method the Corporation buys varying quantities from week to week at a specified price that is related to prevailing market conditions. The quantity is determined by apparent market needs and the available funds. The price may be kept unchanged throughout the program, or adjusted from time to time.

A variation of this method is the negotiated price. In this procedure the Corporation offers a price agreed upon by negotiation with the industry at the same time that the maximum quantity to be purchased is determined. Frequently the industry is permitted to allocate the amounts that will be supplied by the participating industry groups at the specified prices.

The offer-and-acceptance method has been an innovation of the current year. In this purchase method the Corporation invites individuals to make offers to sell designated agricultural commodities to the Corporation. Those submitting offers indicate the price at which they will sell commodities of the quality, size, or other specifications set forth by the Corporation. Offers may be accepted from time to time on a regular basis, i. e., once, twice, or whenever notice is given to the industry. The offers are then reviewed. Acceptance is based in part on the price, the prevailing market prices, the nature of the industry market problem, and from a determination of the maximum quantity that is to be taken at a particular time.

Commodities have also been bought in terminal markets, i. e., in large receiving centers. For the most part this has been accomplished through purchases on exchanges. The Corporation representatives either act directly or through one of the regular marketing agencies to buy on a recognized exchange in exactly the same way as any other participating commercial factor.

Table 11 shows changes in price methods used for some of the principal commodities from November 1935 to May 1938. For dried prunes the negotiated price has been used most generally. For dried peas and beans the fixed price was used in the first two programs; in the current season the offer-and-acceptance method was used. For the milled rice program the offer-and-acceptance method was used. For canned grapefruit juice the negotiated price was used. Canned peas were purchased on the bid basis.

TABLE 11.—*Changes in price methods used by the Federal Surplus Commodities Corporation for some principal commodities, Nov. 1935 to May 1938*

Commodities	Nov. 1936 to June 1936	July 1936 to June 1937	July 1937 to May 1938
Nonperishable:[1]			
Dried prunes	Bid, negotiated	Bid, negotiated	Negotiated price.
Dried peas and beans	Fixed	Fixed	Fixed, offer-and-acceptance.
Milled rice			Offer-and-acceptance.
Canned grapefruit juice		Negotiated	Negotiated.
Canned peas			Bid.
Semiperishable:[2]			
Apples	Fixed		Fixed, offer-and-acceptance.
Fresh pears		Fixed	Fixed, terminal purchase.
Potatoes		Fixed	Fixed, offer-and-acceptance.
Citrus fruits	Fixed	Fixed	Offer-and-acceptance, negotiated.
Perishable:[3]			
Cabbage			Fixed.
Grapes			Fixed.
Butter	Bid, exchange	Bid, exchange	Exchange, offer-and-acceptance.
Eggs	Exchange, negotiated	Exchange, negotiated	Exchange, negotiated, offer-and-acceptance.
Dry skim milk	Bid	Bid	Bid.

[1] The classification used is as follows: Nonperishable commodities are those able to be stored under ordinary conditions for a year or more.
[2] Semiperishable commodities are those that can be kept a month or more after harvest.
[3] Perishable commodities are those that cannot ordinarily be kept over a week without refrigeration.

For such semiperishables as apples, potatoes, and citrus fruits, both the fixed price and the offer-and-acceptance methods have been used. In 1936, apples were purchased at a fixed price. In the current apple program both the fixed-price and the offer-and-acceptance methods were used. Potatoes were purchased under the fixed-price method in the fiscal year ended June 30, 1937, and under both the fixed-price and the offer-and-acceptance methods during the current year. Up to June 1937 the fixed-price method was used in the purchase of citrus. In the current fiscal year the negotiated-price and acceptance methods have been utilized.

For perishable fruits and vegetables the most common practice has been to use the fixed-price method. This was applied in the case of cabbage, grapes, and other vegetables. Frequently, a condition was added stipulating the proportion of the unit price that shall be received by growers, handlers, and others.

For butter programs, bids were used primarily in the period from November 1935 to June 1936, although exchange purchases were also made. During the following year exchange purchases predominated although bids also were used. In the current fiscal year exchange purchases have predominated, with the offer-and-acceptance method also used in the Western Region.

Egg purchases have been carried out by purchases on the exchange, through use of the negotiated-price method, and during the current fiscal year by the offer-and-acceptance method. Dry skim milk purchases have all been made on the bid basis.

With the exception of eggs, butter, dry skim milk, and some relatively small purchases of potatoes and winter pears, purchases have been made at the shipping point, usually from dealers, though frequently from growers as well.

DIVERSION AND EXPORT PROGRAMS

Like the purchase programs for distribution of surpluses among needy persons on relief, the diversion and export programs are authorized by the amended section 32 of Public, No. 320. It may be well to indicate more closely the nature of section 32. Under its provisions, 30 percent of the gross customs receipts for each fiscal year must be kept in a separate fund and may be used by the Secretary of Agriculture only to

(1) encourage the exportation of agricultural commodities and products thereof by the payment of benefits in connection with the exportation thereof or of indemnities for losses incurred in connection with such exportation or by payments to producers in connection with the production of that part of any agricultural commodity required for domestic consumption;

(2) encourage the domestic consumption of such commodities or products by diverting them, by the payment of benefits or indemnities or by other means, from the normal channels of trade and commerce; and

(3) reestablish farmers' purchasing power by making payments in connection with the normal production of any agricultural commodity for domestic consumption.

Programs have been carried out under each of these three clauses. In the programs for special crops, emphasis has been placed on those operating under clauses (1) and (2), which relate to the encouragement of export and of increased domestic consumption through diversion into new or byproduct uses. In actual operation the purposes of clauses (1) and (2) tend to overlap, and in a number of cases the objectives of both have been included in one commodity program.

There is no exact formula for determining the amount of the benefit or indemnity payments under either the export or diversion programs because of the varying conditions found in connection with each farm product. The Administration has attempted, however, to make such payment to the person exporting or diverting the product as will, to some extent, make up the loss that would be incurred in the exportation, manufacture of byproducts, or other use outside of the normal trade, as compared with the value of the same product in the regular market.

The principal gain to producers is through the support given to the price of the larger portion of their crop which is sold through regular market channels. The purpose of the programs is to divert only surpluses which operate to depress too sharply the price of the regularly marketed portion of the crop. Therefore payments under diversion and export programs have not necessarily been fixed at a level which offers a profit on the surplus itself. Producers are expected to be willing, except in special cases, to accept some sacrifice on their returns from the surplus, in view of the enhancement of their returns from the much greater portion of their crops moving in regular channels.

At the time the first programs were initiated it was not possible, except in a few cases, for the industries to put into effect any programs which would supplement the assistance given by the A. A. A. under section 32. But in the past year or so a strong attempt has been made to encourage the various industries, which asked for help, to develop plans of their own either through marketing agreements or other plans, sometimes under State laws, for the control of their

products, so as to make more effective the assistance granted by the A. A. A.

The export programs.—Encouragement of exportation under clause (1) of the section 32 provisions may have one or more of the following objectives:

(*a*) The relief of a surplus situation in the United States where an export benefit or indemnity payment is necessary to enable the exporters to compete or to increase the quantities exported.

(*b*) The development of new world markets for United States products which are not known or in which additional volume of trade or new markets can be developed.

(*c*) The recovery of markets which were lost through unusual world trade conditions.

Typical of the export programs developed under (*a*) above are the export phases of the combined export-diversion programs undertaken for California standard dried prunes. Plans for these programs were initiated and proposed by representatives of growers and handlers of prunes in the Pacific Coast States and covered prunes grown in the States of California, Oregon, and Washington. During the crop year 1934–35 growers and packers had operated a pool for the purpose of improving the marketing conditions of prunes. Several thousand tons of substandard grades were held by the pool.

The export programs undertaken for pecans and pecan meats are illustrative of programs developed in an attempt to open new world markets. The first of these programs was announced on April 23, 1936. It provided for a benefit payment of 5 cents per pound on pecans of the 1935 crop exported and resulted in the exportation of 788,789 pounds at a cost of $39,439.

The export programs for exports of flour made from Pacific Northwest wheat represent a type of program undertaken, at least in part, for the recovery of markets lost through unusual world trade conditions. The first of these programs was approved February 28, 1936, for exports to the Philippines. The rate of the indemnity was fixed in accordance with a formula which took into consideration the market prices of wheat and flour in the Pacific Northwest and the export prices to the Philippines. The indemnity payment averaged 82.2 cents per barrel of flour which is equivalent to about 18.5 cents per bushel of wheat. The total quantity on which the indemnity was to be paid was limited to 65 percent of the estimated total imports of flour into the Philippines for the period during which the program was in effect.

This program was designed to improve the situation in the Pacific Northwest where the geographical location of the wheat and the fact that the wheat raised was largely of the soft types caused the prices for such wheat to be relatively lower than the general wheat price in the United States.

Another objective of the plan was to enable United States exporters to regain their business in the established brands of flour which were well known in the Philippines. It was believed that if these brands failed to appear on the market for any considerable period the result of many years' work in building up the demand would be lost. The

world wheat situation was such that it was not possible to manufacture flour from Pacific Northwest wheat purchased at regular prices and sell it in the Philippines in competition with wheat and flour from other countries.

Under this plan, 193,931 barrels of flour were exported and the indemnity paid amounted to approximately $159,000.

On June 29, 1936, a plan similar to the foregoing was made effective, under which 426,219 barrels of flour were exported to the Philippines and the total indemnity paid by the Administration was approximately $232,000. The rate of payment averaged 54.4 cents per barrel of flour, equal to about 12.2 cents per bushel of wheat.

On July 1, 1937, a third program was approved. This program covered the period from July 1, 1937, to June 30, 1938.

Export programs embodying principles similar to those outlined above for prunes, pecans, and Pacific Northwest wheat, have also been undertaken for walnuts, tobacco, and fall and winter pears.

The diversion programs.—Diversion programs which are authorized under clause (2) of section 32 are those wherein products are diverted from the normal channels of trade and commerce into other channels or uses and can be divided in a general way into the following classifications:

(*a*) Diversion into byproducts or uses into which the particular product or a particular quality of such product does not usually go.

(*b*) The diversion of products into special areas where such products are not usually sold.

(*c*) The diversion of substandard grades to prevent their use in cheapening the pack of standard grades.

An illustration of the programs developed under (*a*) above is found in the diversion program for cotton. On March 4, 1936, a plan was approved for the diversion of unmanufactured cotton into the manufacture of fabric for use on bituminous surfaced roads and for cotton mats for curing concrete. The object of this program was to distribute these materials to State highway departments for use in road-building programs in order that the experimental use of these products would develop new and permanent uses for them. Products covered by this program were distributed to various State highway departments upon their application. Contracts for manufacture were made through bids obtained from manufacturers to supply the material according to the approved specifications. The quantity of cotton used in manufacturing the fabric was 8,194 bales and the cost of the program was about $734,000.

On August 21, 1937, another plan was approved for uses similar to, and in some respects a continuation of, those in the plan of March 19, 1937, but with the later addition of cotton material for making bags for packaging wool and other products. Under this program 1,534,925 square yards of cotton fabric were used requiring 1,394 bales of cotton. The cost of the program was approximately $135,331. The manufactured material was used in about 200 projects located in 42 states. The principal uses were for ditch lining, road work, protective covering for trees and vegetables, covering for cotton bales and bags for agricultural or horticultural products.

The best illustration of diversion programs undertaken to increase sales in special areas is found in the programs developed for fall and winter pears. For a number of years before 1936 these varieties of pears had been selling at relatively low prices, and a large production was indicated for the 1936 crop.

Upon application from the California Pear League, representing a majority of the producers of pears in that State, the California Pear Diversion Plan was approved August 4, 1936, with provisions for indemnity payments on exports to specified foreign countries and on pears diverted from the normal channels of trade into specified places in the United States. Winter pears were relatively unknown in a block of 18 States in the central and southern parts of the United States and payments were to be made on shipments into those States. The program was operated through the California Pear League.

The rate of the indemnity payment was determined by the difference between the average sales in normal domestic markets and the net proceeds of the sales for export or diversion, with a limit of 50 cents per box average on all pears exported or diverted.

On November 21, 1936, another plan covering the 1936 crop was approved for the purpose of giving the same benefits to pears produced in Washington and Oregon. This plan was similar to the California plan, and the Oregon-Washington Pear League was formed to handle the operations. The total quantity of pears diverted under both plans was 73,148 boxes, and the indemnity payments amounted to a total of $35,444.

Because of indicated high production for the 1937 crop a program covering that crop was approved October 9, 1937. The California League combined with the Oregon-Washington League in one corporation entitled the Oregon-Washington-California Pear League, Inc., which operated the program for all three States.

The program was simplified by providing for a flat benefit payment on all pears exported or diverted. In line with the experience in the previous plan this rate was fixed at 50 cents per box. The total quantity exported and diverted was approximately 75,000 boxes, of which about half were exported. The benefit payments amounted to about $38,000.

In both the 1936 and 1937 crop years these programs, together with purchase programs, had the effect of increasing the prices which had started at a low point earlier in the season, to a relatively fair price toward the end of the season, although the average prices were still too low to put the industry on a satisfactory basis.

The programs undertaken for dried figs are representative of a number of programs for the diversion of substandard grades to prevent their use in cheapening the pack of standard grades. The dried fig industry exists almost wholly in the State of California. It encounters production and handling difficulties peculiar to itself. Because of susceptibility to insects and disease damage, a large proportion of figs is defective. Package figs for direct consumption shipped in interstate commerce are covered by the Food and Drugs Act and are of high quality. The lower grade figs, however, after cutting and selecting, are used in the manufacture of fig paste. Such use provides a price advantage to handlers willing to use the lowest grades and tends to reduce the price for standard quality figs.

For this reason, the industry, through the California Fig Institute, applied for a program under section 32 for the purpose of diverting from the normal trade, figs which contain too many defects to permit their use under reasonable preparation for standard pack figs or fig paste.

The first diversion program was approved on August 14, 1936, and provided for indemnity payments for the difference by which the purchase price of the figs exceeded the sales price for diversion purposes plus the expenses in handling the figs. The purchase and sales prices were fixed by the Secretary, the former according to the grade of the figs and the latter in accordance with the diversion use. The diversions authorized were to commercial alcohol, brandy, feed, and syrup. A special nonprofit corporation, the Pacific Dried Fruit Products Association, was formed to handle this program, making purchases of substandard figs from the growers and sales into the diversion outlets. Most of the substandard figs were diverted into livestock feeds.

Under the first program, a total of 2,768 tons were diverted at a total cost of $75,025.

For the 1937 crop the industry established a prorate under California laws which made it mandatory for growers to deposit, under the control of the Prorate Commission, substandard figs of the grades which had been diverted in the previous years.

In order to supplement the efforts of the industry to so improve its business, a second plan was approved on September 24, 1937. This was similar to the previous plan except that it was simplified by establishing a schedule of flat benefit payments according to the variety and grade of the figs diverted. These rates were fixed in accordance with the experience in the previous crop, but were reduced somewhat under the costs of the previous program in order to encourage the industry to carry a larger share of the cost of improving its marketing conditions.

This program was also handled by the Pacific Dried Fruit Products Association, and the total quantity of figs acquired for diversion was about 4,170 tons, on which the cost to the Government is estimated to be about $85,000. The benefit payments ranged from $8 to $30 per ton.

The fig industry reported that these programs had caused improvement in prices which on the whole of the crops amounted to many times the amount expended by the Government under these programs and that the marketing condition had been improved by the elimination of the substandard figs.

Diversion programs similar to those summarized above for cotton, pears, and dried figs have also been undertaken for peanuts, raisins, dates, filberts, walnuts, oranges, apples, hops, sweetpotatoes, Irish potatoes, tobacco, and Puerto Rican coffee.

Programs to reestablish purchasing power.—Two programs have been developed under the amended clause (3) of the section 32 provisions which reads: "(3) Reestablish farmers' purchasing power by making payments in connection with the normal production of any agricultural commodity for domestic consumption." Both of these programs have been undertaken in connection with fiber flax.

The United States has always imported most of its fiber flax but a small industry has been established in Oregon. The industry made arrangements with the Works Progress Administration for the erection of three processing plants in an attempt to develop this industry into a commercial business. In 1936 prices had reached a relatively low level and the industry applied for assistance from section 32 funds under clause (3) of the act. A program was approved on June 20, 1936, which provided for payments at the rate of $5 per ton of field-cured fiber flax straw suitable for the production of spinning fiber. It was determined that this payment would, in a large measure, reestablish the purchasing power of such domestically produced flax straw. Payments under this plan were limited to a quantity which was determined to be the normal production for domestic consumption in 1936.

Under this program payments were made on a total of 5,163 tons at a total cost of $25,297. The plan was based on applications of growers who were required to submit evidence as to the amount of flax straw produced and sold by them for the production of fiber.

A second plan for fiber flax was approved on April 14, 1937. This plan was similar to the previous one except that in accordance with changed marketing conditions it was determined that a payment of $7.50 per ton would be the proper rate for carrying out the provisions of the act. Under the second program payments were made on 4,398 tons in a total amount of $32,985.

EFFECTIVENESS OF THE PROGRAMS

In a general way the plans which have been operated under section 32 have been successful, at least to some extent, in accomplishing the objectives of the programs, and in a number of the programs the results have been extremely satisfactory. Some of the principal benefits to agriculture were the establishment of new markets, improvement of prices, and the elimination of the poorest grade from distribution to consumers.

However, because of the many factors which enter into the marketing and distributing of crops, the programs initiated under section 32 cannot permanently solve the difficulties of the agricultural producers. For this reason, plans of this kind should be considered as largely temporary. In some cases assistance is justified only for a very short period because of some unusual emergency, and in other cases it may be necessary to give assistance over a period of years in order to give the industry an opportunity to make adjustments which will permit fair returns to the producers.

In some programs the objectives are clearly evident. In the case of pecan exports, for instance, it was found possible to develop a market where this article was little known or used. In other export programs there is likewise the possibility of developing new markets. On the whole, however, the benefit payments are used for the purpose of reducing prices to a point which will permit competition with the same or similar articles which are selling in the world markets at prices below domestic prices and sometimes even below domestic cost of production.

In these cases, it is necessary to consider carefully the probable effect on foreign trade and to avoid situations that might disturb present trade relations or result in retaliation on the part of one or more foreign countries. With the aid of export benefit payments, it is possible to undersell world producers, but to do so without considering the probable adverse effects would eventually result in a loss to all agriculture rather than a gain.

In connection with diversion programs the ideal objective is to find a diversion which will become a permanent use, and in some programs such as cotton cloth for roads and other agricultural uses, sweet potatoes into starch, and other new diversions, this has been accomplished.

There are, however, many diversions which are for the purpose of assisting an industry to develop further a byproduct which is now being produced. An example of this type is found in the diversion of walnuts in the shell into shelled walnuts. Sales of shelled nuts are now an important part of walnut distribution and must in due course be considered as one of the normal outlets.

Other diversion plans, such as that for peanuts into oil, are purely temporary and are basically for the purpose of removing a surplus from the normal markets. Although low-grade peanuts are normally converted into peanut oil, it is not likely that the grade of peanuts which can be distributed for consumption as nuts will be turned into oil without a payment of some benefit for doing so.

Producers of agricultural products who are now receiving help under section 32 must eventually develop permanent plans to take care of their marketing difficulties either by avoiding overproduction or by developing markets for the surplus products which, together with the normal sales, will produce a reasonable return on the whole crop.

Inasmuch as the funds available under section 32 are insufficient to take care of all cases where the income of the producers is below normal, it is necessary to give assistance to those industries which are in the most difficult position. Likewise, in order to encourage the agricultural industries to do something for themselves through such means as marketing agreements, State regulations, or voluntary regulation, it is desirable that justified assistance be given whenever possible to such industries as are already making use of the means available.

The situations in connection with the various farm products differ considerably from year to year, and the kind of assistance which will be useful depends upon the conditions peculiar to the crop in question. Moreover, the two general types of crops, the tree and perennial vine crops on the one hand and the annual crops on the other, introduce other difficulties. In the tree crops there are a number of cases of overproduction which are the result of heavy plantings several years ago when prices were high, and in such cases the plans which are formulated must be such as will not encourage additional plantings but will aid the industry in gradually reducing its producing acreage to a point where production will about meet the needs for consumption. On the other hand there are tree crops which produce an abnormal crop in one particular year, and in such cases the assistance given should be purely seasonal for the purpose of assisting the industry to dispose of its temporary surplus.

The problem in connection with the annual crops is just as difficult, for when plans under section 32 raise the income to a point which is fairly satisfactory the problem becomes one of seeing that producers do not continue to produce heavily so as to bring about a continuing surplus. It is, therefore, necessary that the assistance which is given in all of these cases be kept down to a level which will save the producer from disastrous results but which will not cause sufficiently high returns to encourage the continuous production of surplus crops every year.

X. NEW ACT AND NEW PROGRAM, 1938

While obviously a detailed account of operation of the Agricultural Adjustment Administration through 1938 is not possible in this report, still a brief review is needed of the swift and significant developments occurring up to the close of the fiscal year on June 30.

The outstanding event of the year was the enactment on February 16 of the Agricultural Adjustment Act of 1938.

This act wrote into law the basic new farm legislation which farmers had long been expecting. Ever since the United States Supreme Court in its Hoosac Mills decision of January 6, 1936, had declared unconstitutional the processing tax and production-adjustment provisions of the original Agricultural Adjustment Act of 1933, the farmers had been looking forward to enactment of new general farm legislation.

The new farm act sought to assist in building the foundations of a long-time policy for American agriculture that would protect farm income and safeguard soil resources.

The new act took advantage of the experiences of the drought years and wrote into law a plan for an ever-normal granary for food and feed, with controls of excess supplies and use of the surpluses of big crop years to offset the shortages of small crop years. It took advantage of the experience in administration of the 1936 and 1937 Agricultural Conservation Programs. The act amended significantly the Soil Conservation and Domestic Allotment Act, and provided new legislation that in all probability will have significant effects upon farm programs for a long time to come. An account of this legislation, supplementing the review already given in chapter 2, is therefore a natural prelude to the brief discussion that is possible in this report of the agricultural conservation programs of 1938.

THE REASONS FOR THE NEW ACT

The shaping of the new farm act was in the foreground during all the time that the 1938 Agricultural Conservation Program was being formulated. In fact, the forces that finally brought the new act into being had been in motion even before the Hoosac Mills decision of the Supreme Court. It will be remembered that in his public statement of October 25, 1935, President Roosevelt had announced the intention of his Administration to develop out of current agricultural programs a long-time farm policy, and had described the essential elements such a policy should contain. Thus by the fall of 1935, the groundwork had been laid for action, legislative as well

as administrative, that would round out and perfect the national farm policy. While it is true that this was the period of mounting legal warfare in the courts by the meat packers, textile and flour millers, and other processors against the agricultural adjustment program, any supposition that a court decision favorable to the processors would bring an end to the movement for a strong and enduring national farm policy was out of line with the realties. The movement to establish that farm policy was well under way when the Hoosac Mills decision was handed down by the Supreme Court. The effect of the decision was to add impetus to the movement.

The need for more comprehensive legislation.—One result of the decision was the immediate enactment, as has already been related in chapter 2, of the Soil Conservation and Domestic Allotment Act to carry on the program in 1936 and 1937. But another result was an increasing demand from farmers and farm leaders for ultimate enactment of more comprehensive legislation. In fact, the recommendations of the national conference of farm leaders which was called by Secretary Wallace to meet in Washington soon after the Hoosac Mills decision, to consider the situation created by the decision, had showed how strongly farmers then hoped that an emergency measure would be followed by legislation of a more general and permanent type.

The plans for the 1938 Agricultural Conservation Program had to go forward simultaneously with the hammering out in the law-making processes, which were in motion before the close of the regular session of Congress in the summer of 1937, of the central provisions of the new farm act.

The accumulation of surpluses.—The uncertainty regarding the form that important provisions of the new farm act would finally take was, however, only one of two factors that bulked large among the conditions that had to be reckoned with in the construction of the conservation program of 1938.

The other factor—which also spurred the demand for a new farm act—was the return in 1937 of normal growing conditions in this country. With the reappearance of normal weather after the droughts of 1934 and 1936, and the production of normal or larger than normal crops in 1937, the forces that had led to the enactment of the original Agricultural Adjustment Act reasserted themselves promptly and vigorously. American farmers again began to feel the results of losses of foreign markets for their export crops—losses resulting from the transition of the United States during the World War from a debtor to a creditor Nation, and from the consequent lack of ability of foreign nations to buy our surpluses.

When surpluses began to accumulate again as the combined result of the continuing lack of foreign markets and the return of normal weather, farm prices began to decline. Price losses were felt less in some export crops than in others—for example, prices of the 1937 wheat crop held up much better than cotton prices, because of the short world crop of wheat and the record crop of American cotton that year—but the downward farm price movement beginning in 1937 and extending into 1938 was general, and its consequences were important. Secretary Wallace has said that half of the economic problem of agriculture is in the cities and half of the economic problem of the cities

is on the farm. The lower prices received by producers of the export crops in marketing seasons of 1937 and 1938 tended to reduce their buying power for the products of city factories. The consequent increase in factory unemployment was no doubt one factor in the general business recession that developed in the fall of 1937. The buying power of cities for the products of the farm was in turn diminished, and this decline in consumer-buying ability hurt especially the producers of milk, meat, vegetables, and other products which are absorbed primarily by the domestic market. In this way, the situation that at first injured the growers of wheat, cotton, pork, and other export crops, gradually began also to result in smaller returns for the dairymen, the cattle growers, and fruit and vegetable producers.

The rising unemployment.—These effects, while cumulative, might not have been so severe in themselves had they not been made more grave by developments at the city end of the farm problem.

A general movement developed among large-scale manufacturing industries to reduce inventories, and this resulted in cutting down employment. The loss of jobs by city workers not only reduced still more the power of city consumers to pay fair prices for farm products but also tended to reduce the supplies of things the farmer had to buy, while there was a superabundance of commodities that the farmers had to sell. The effect of this curtailment of city employment and city production was to hold up prices of industrial commodities while farm prices were falling and in this way to lower the exchange value or real value of farm products. This created new economic disadvantages for the farmer.

All sides of this whole situation—the falling farm prices, the reappearance of injuries to agriculture resulting from loss of markets abroad and accumulation of surpluses at home, and the evidence of the effects on agriculture of the practice of industrial production control—all of these factors made up the background of the 1938 farm program.

The decline in farm prices reached a point where estimates of farm cash income for the year were reduced to $7,500,000,000. This was $1,100,000,000 less than the estimated farm cash income of 1937, but still about $3,000,000,000 above the farm cash income for 1932.

While far different in degree from the disastrous conditions of 1932, the situation was developing similarities in kind to that of the depression. Again as in 1932 the farmers had produced a superabundance of food. But with surpluses piling up, breadlines instead of shortening were lengthening, unemployment was growing, and once more it was being proved that when farm surpluses injure farm buying power they mean not less but more hunger in the cities. Once more, as in 1933, the Federal Government moved to meet the situation with an employment program, and as it was launched conditions began to improve. That did not come, however, until after the farm act had finally been enacted.

The situation that was developing for the farmers in the fall of 1937 while farm prices were slumping and the recession was getting under way makes entirely clear the reason for their insistent demands for legislation that would restore to farmers in some form the protection which the Hoosac Mills decision had taken from them.

While the declining farm prices increased the prospects that fundamental farm problems would win recognition in a new farm act, the

conditions did not remove uncertainties as to what form the new farm proposals might take and when they might finally be enacted into law.

In the fall of 1937, these uncertainties constituted a serious problem for the farmers. The farmers were under the necessity of planning their 1938 production in the face of mounting surpluses and the actuality or the definite prospect of falling prices. Winter crops were already sown or being sown, and fall plowing was in full progress.

PREPARATIONS FOR THE NEW LEGISLATION

In view of all the circumstances, it seemed particularly important that the farmers and the Congress be afforded as early as possible all the information available that would have a bearing upon the farm program for 1938. With this in view, two important things were decided upon. They were:

First, on the basis of the existing law but making due allowances for obvious uncertainties, the outlines of the proposed agricultural conservation program for 1938 which had been worked out in the summer of 1937 were announced on September 20, 1937. As rapidly as possible the details were filled in, and the completed program for the next year was announced on October 25.

Second, the Secretary decided to give to the public, the farmers and the Congress an analysis and review of the problems facing the producers of the big export crops, cotton, wheat, and corn, together with a candid statement of his recommendations as to some of the principal legislative provisions for these crops. This was done in a series of three speeches in the fall of 1937.

By these two methods, early and definite information was made known, as to what would be the nature of the 1938 Agricultural Conservation Program if new legislation were not enacted; what the provisions of the program would be in all respects that might not be changed or affected by the provisions of any new legislation; and what changes in the act the Administration hoped to see accomplished in time to give producers more protection on their income from their 1938 crops.

Thus the announcement on September 20 of outlines of the Agricultural Conservation Program preceded the opening of a Nation-wide series of hearings on the new legislation that subcommittees of the Senate Committee on Agriculture and Forestry conducted, beginning at Spokane, Wash., on September 30.

The outlines of the 1938 program as announced on September 20 were based on recommendations of county and community conservation committees all over the country, summarized and discussed in a conference of State conservation committeemen and Extension Service officials in Washington September 14 to 16. Therefore the Senate subcommittees had before they started their hearings a summary, in the form of the outlines of the program, of farm opinion as to what a 1938 program worked out under existing legislation should contain.

Continuing this effort to make public ample information, the Secretary's discussions and the announcement on October 25 of the details of the program had both been made before the Seventy-fifth Congress came together on November 15, in the special session sum-

moned by the President to deal with pressing economic problems, including those of agriculture.

THE WRITING OF THE NEW ACT

But the writing of the new national farm act by Congress naturally proved to be a long, hard job. The task of grappling with agriculture's most pressing economic problems took time. The new legislation had to be shaped to meet, not only the economic facts, but also the complicated technical requirements of current constitutional law.

Congress sought with especial care to make certain that the new act was safeguarded against any possibility of invalidation by the courts on grounds of unconstitutional delegation of legislative power. This required the spelling out in great detail of specific instructions to the Secretary of Agriculture. Complicated economic situations had to be anticipated, and the line of action to be taken had to be thought out in advance and then authorized in legal language. The spelling out of the regulations resulted in the lengthening of the statute. The opponents of farm legislation who had been attacking the earlier and more general farm acts on the ground that their broad powers made the Secretary of Agriculture a "dictator" now began to assail the new law for giving him specific directions on every point, condemning and ridiculing the new act for being too long and too complicated.

As might have been expected, a large amount of time and effort was required in Congress to resolve differences in viewpoint on important questions of policy arising with regard to important parts in the pending farm bill. There were different shades of opinion in the two Houses of Congress, and on the part of the Secretary. While in many respects they were in substantial agreement, the committee bills differed from each other in some of their main provisions. So far as the Secretary's recommendations were concerned, the Senate bill in particular at some stages of the legislative process represented considerable differences in approach.

One example of this variation in viewpoint was with regard to the degree of rigidity of marketing quota restrictions. Differences of opinion arose on this point. The Secretary urged that in order to be practical, marketing quota provisions should be moderate. He contended against application of a rigid formula providing for using flat percentages of tillable land within counties in the fixing of cotton acreage allotments. He argued for increasing the bill's normal supply and marketing quota levels for wheat and corn to make sure that none of the methods for marketing regulation could be used or a referendum held until surpluses were large and the Ever-Normal Granary was running over. He recommended against the fixing of loan rates on wheat and cotton, except in an emergency, at levels so high as to fix prices above world prices, and hence stop our exports of these two commodities. He urged enactment of a provision for the levy of processing taxes on cotton and wheat so that the making of parity payments, that the producers of these commodities needed to give them parity income, would not result in further unbalancing the Federal budget.

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As the act was rounded into final form in Congress, its provisions and the amendments thereto represented accommodation of views on most of these points. Marketing quota levels for cotton were increased to more moderate levels than originallly proposed in the Senate bill; a compromise was reached on normal and marketing quota levels for corn that decreased the probability of referenda on the use of quotas; and the national acreage allotment for wheat planted for the 1939 harvest was increased to 55,000,000 acres, with a provision which meant that no quotas would be used until 1939. The Price Adjustment Act of 1938, approved June 21, 1938, appropriated $212,000,000 for parity payments, but no processing taxes were enacted. As it was finally worked out, the new adjustment act represented a remarkable accomplishment by congressional leaders and members of the agriculture committees of Congress in reconciling differences in point of view on its important provisions, and in piloting the measure safely through the controversies that threatened it.

GENERAL OBJECTIVES OF THE ACT

The new National Farm Act, known as the Agricultural Adjustment Act of 1938, finally became a law on February 16. In general, Congress declared the purposes of the new national farm legislation to be:[4]

> To conserve the Nation's soil resources and use them efficiently.
>
> To assist in the marketing of farm products for domestic consumption and export.
>
> To regulate interstate and foreign commerce in cotton, wheat, corn, tobacco, and rice, so as to—
>
> Minimize violent fluctuations in supplies, marketings, and prices of farm commodities;
>
> Protect consumers by maintaining adequate reserves of food and feed; and
>
> Assist farmers in obtaining a fair share of national income.

These purposes are for the benefit of agriculture and for the welfare of the entire Nation.

The act provides for a farm program open to participation by all farmers in the United States.

In the foregoing pages, reference has been made to the Agricultural Adjustment Act of 1938 as resulting from a desire of farmers for more comprehensive legislation than they had prior to its enactment.

The new act is well described as being comprehensive. Together with related legislation already in effect, the act is designed to integrate an agricultural program which includes various methods and approaches. Among the different measures which the new act seeks to weave into a general farm program are soil conservation on a Nation-wide scale; acreage allotments to help stabilize production;

[4] The review of the Agricultural Adjustment Act of 1938 contained in this chapter is taken from a short summary of its provisions that was published soon after the act was signed. The text of the act is published in appendix G.

loans to finance farmers to hold larger carry-overs in surplus years; marketing quotas for surplus control of marketings in time of emergency; crop insurance for wheat; marketing agreements to avoid market gluts, especially of perishable crops and dairy products; subsidies of consumption for relief purposes by surplus relief buying operations; diversion of excess supplies to industrial uses and for export; and contributions to farm income through the making of parity payments. So with the passage of the new farm act, the Government more fully integrated the foregoing list of powers. Coordinated into a single farm program, these powers could now be used, singly or in combination, as seemed most practicable and effective in meeting the changing problems and difficulties facing the farmers. Together with companion legislation, the new act summarizes both the results of nearly 18 years of agitation, dating back to the post-war depression, for a national farm program and also the legislative and judicial experience and the administrative experience of the A. A. A. since 1933.

THE PROVISIONS OF THE ACT

One part of the act strengthens and continues the provisions of the Soil Conservation and Domestic Allotment Act under which about 4 million farmers took part in the agricultural conservation programs of 1936 and 1937. These provisions will be available, as in the past 2 years, to every farmer. They authorize continued payments to farmers who take part in the agricultural conservation program.

Another part of the new act supplements the conservation programs with provisions for regulating interstate and foreign commerce in the five commodities listed in the act—cotton, wheat, corn, tobacco, and rice.

Both parts of the act are designed to safeguard the efficiency of agriculture. All payments are to be conditioned upon participation in measures for soil conservation. Both parts of the act are designed to help in stabilizing commerce in agricultural products and to assist farmers in obtaining a fair share of the national income.

The provisions of the act may be broadly summarized as constituting a program designed to assist farmers to market abundantly year after year. They are designed to protect agriculture against the price collapses that heretofore have penalized heavy production. The act provides actual methods such as acreage allotments, marketing quotas, and commodity loans, to help give the stability of income that farmers need in order to grow and to maintain ample reserves of farm commodities for the Nation's use. In effect, this means that an Ever-Normal Granary will be started. The act's provisions affecting reserve supplies were expected at the time the act was signed to be accompanied by the approximate doubling of the average annual carry-overs of corn and wheat.

The provisions may be briefly grouped and summed up as follows:

1. The A. A. A. soil-conservation program is continued and its objectives established as a part of permanent farm policy in the interests of future abundance of food and fiber.

2. Systematic storage of food and feed surpluses from big crop years for use in years of shortage is assisted by commodity loans.

3. Marketing quotas for commercial producers of cotton, wheat, corn, tobacco, and rice, backed by penalties on sales in excess of the quotas can be used, subject to approval of two-thirds of the producers voting, to obtain general participation of farmers in a program designed to hold surplus supplies of the five listed commodities off the market until they are needed. Release of supplies withheld from market under marketing quotas is provided for in case of any unforeseen shortage.

4. Crop insurance for wheat, starting with the 1939 crop, will give wheat producers and bread consumers better protection against crop failure. Gradual accumulations of wheat paid in by farmers as insurance premiums will contribute to the Ever-Normal-Granary supplies.

Referendum provided.—An essential point in the new farm act is the fact that when excessive supplies pile up, producers themselves have the final say through a referendum as to whether marketing quotas for the five listed commodities are to be used or not.

In years when surpluses call for use of marketing quotas, the referendum must be held soon after the quotas are announced. If two-thirds of the producers voting favor the quota, it will be used, but if more than one-third of the voters oppose the quota, it will not go into actual operation.

Farm income protected.—Protection of farm income is a vital purpose of the new farm act. It seeks to give farmers a larger and steadier share in the national income. Specifically the act affords farmers the following measures of income protection:

Payments to farmers who cooperate in the Agricultural Conservation Program.

Additional "parity" payments, when funds are made available. An appropriation of $212,000,000 was made for this purpose in 1938.

National acreage allotments to encourage plantings in line with domestic demand, foreign markets, and ample carry-overs, and that avoid sudden and extreme acreage shifts.

Storage loans to enable farmers to carry over unusually large supplies until the market needs them and they can be sold at fair prices.

Marketing quotas, together with the storage loans, to hold unusual surpluses out of glutted markets and to protect the value of commodities.

The Act requires that funds available for payments be divided among crops on the general basis of their average acreages and average value in the past, and the extent of the adjustments required. Specific provisions protect dairy, livestock, and poultry producers against increased competition arising from changes in land use under the program. In general, the act is also expected to help these producers by decreasing the likelihood that low prices will drive producers of corn, wheat, cotton, etc., into competition with them.

The national acreage allotments established for corn, wheat, and rice, and, under the Soil-Conservation and Domestic Allotment Act, for tobacco, are required to be divided equitably among the States producing these commodities. The State allotments are then divided among counties, and the county allotments among individual producers. The national cotton allotment (in bales) is converted into acres and then divided among States, counties, and individual farmers. All county allotments are apportioned among individual farmers through the local and county committees.

Marketing and storage quotas for the five listed commodities can become effective only when supplies exceed normal by amounts definitely specified for each commodity, and then only when approved in a producers' referendum. The supply levels which must be exceeded before quotas can be put into use include reserves and carryovers larger than usual. To protect farmers who wish to hold products in storage when markets are becoming glutted and prices are threatened with collapse, the marketing-quota provisions when voted effective place penalties on excess marketing. The quota provisions apply to all producers, but are subject to termination in a national emergency, and must be adjusted or suspended to meet a shortage in domestic supplies or increases in exports.

The act requires, also, that all acreage allotments and marketing quotas be kept available for public inspection, and sets up a system of local committees for reviewing the quotas of any farmers who are dissatisfied and appeal for a review.

Parity payments.—The Agricultural Adjustment Act of 1938 authorized payments of Federal funds directly to producers of corn, wheat, cotton, rice, or tobacco for the purpose of reestablishing farm income and purchasing power somewhat nearer the pre-war level. Such payments were authorized to be made to producers on the normal production of the listed commodities, if and when appropriations were made for them, and were to be allocated among commodities on the basis of the amount by which the farm prices of the commodities were below parity. These payments were to be in addition to and not in substitution for any other payments.

The Agricultural Adjustment Act of 1938 made no appropriation for this purpose, but the "Price Adjustment Act of 1938," title V of the Work Relief and Public Works Appropriation Act of 1938, approved June 21, 1938, appropriated $212,000,000 for these payments. Under the terms of the act parity payments on any crop are to be made only to producers who do not exceed the acreage allotments established for such crop for their farms under the 1939 Agricultural Conservation Program, and the payments are limited to the amounts required to bring the return, including the farm price, from any commodity up to 75 percent of the parity price. The payments are to be made on the basis of the normal yield of the farm acreage allotments established under the 1939 Agricultural Conservation Program.

The amount of money allocated to each of the five commodities is determined in part by the allocations used in the Agricultural Conservation Program, and in part by the amount by which farm income from 1938 production of each commodity is below parity income.

Cotton price-adjustment payments.—The Third Deficiency Appropriation Act, approved August 25, 1937, made available $130,000,000 for price-adjustment payments on cotton harvested in 1937.

The object of the payments is to assure cotton producers who cooperate in the Agricultural Conservation Program an average return of 12 cents a pound for their cotton, or as nearly that return as possible. Payments are made to individual producers on 60 percent of their base cotton production as established by the 1937 program. Provision is made for payments on cotton which is held by the producer as well as on that which is sold. Cotton held by the producer is assumed to have been sold on June 30, 1938, at the official average price on that date.

Funds for this appropriation are derived from customs receipts under the provisions of section 32 of Public, No. 320, $65,000,000 being appropriated from receipts for each of the fiscal years 1938 and 1939. No payments under this program had been made up to July 1, 1938.

Increase in small payments.—The attempt to give tenants and small farmers increased protection is one of the important features of the Agricultural Adjustment Act of 1938.

Equitable division of benefit payments between landlord and tenant is required. In general, the division is to be on the basis of the interest each has in the farming operations and of the contribution each makes to the conservation practices followed.

Additional protection is given by increasing the size of payments on small farming operations. These increases are made to producers who otherwise would receive payment of $200 or less.

The amount of the increase is determined according to a schedule fixed in the act as follows:

Payment earned	*Amount of increase*
$20 or less	40 percent.
$21 to $40	$8 plus 20 percent of amount over $20.
$41 to $60	$12 plus 10 percent of amount over $40.
$61 to $186	$14.
$187 to $200	Enough to increase payment to $200.

CHANGES IN THE 1938 PROGRAM

Enactment of the new act on February 16 brought a period of intense activity in the Agricultural Adjustment Administration.

The work of making the changes that were necessitated in the 1938 program, so as to bring it into line with the new act, was pushed forward. This had to be done with all possible speed, especially in the cotton and tobacco areas of the South where the season was most advanced and the referenda were to be held on March 12.

The general provisions of the 1938 Agricultural Conservation Program as announced the previous October stood up very well in their application to the general farming, dairy, and other areas outside the regions producing heavily of the export crops. With respect to the export crops, cotton, tobacco, corn, wheat, and rice, the passage of the act set in motion efforts to apply the new provisions in particu-

lars where they required changes in plans, or authorized the carrying forward of program operations which had been awaiting final enactments.

However, a description of the steps which were taken to apply the provisions of the new Farm Act to the surplus crops immediately affected should be preceded by a brief statement of the essentials of the 1938 Agricultural Conservation Program before the act was signed.

Soil-building goals.—In place of the minimum acreage of soil-conserving crops which had been provided for under the 1937 program, the 1938 program provided for a soil-building goal for each participating farm. This goal could be attained by adopting soil-building practices, including the planting of certain soil-conserving crops. The acreage of soil-conserving crops for the country as a whole in 1938 was placed at approximately 95,750,000 acres, an increase of 25,250,000 acres over the average for the 10 years 1928–37.

The soil-building practices which might be followed in achieving the soil-building goal for the individual farm were very largely the same as those for which definite payments were made under the 1937 program, but payments were of one type instead of the three which had been used the year before.

In 1938 payments were based principally upon observance of the various soil-depleting crop acreage goals set up for individual farms. Thus, the size of these goals largely determined the amount of benefit payment a producer could obtain. Other bases of payment were the adoption of approved soil-building practices and, in areas subject to serious wind erosion, the restoration of land to a permanent vegetative cover. All bases, however, were blended into one goal for the individual farm, and full attainment of the goal was necessary if full payment was to be earned.

Deductions from full payments were made if acreage allotments for soil-depleting crops were exceeded, if the soil-building practices followed on the farm fell short of the established goal, or if other practices were followed which tended to defeat the purposes of the program. In areas subject to serious wind or water erosion hazards, the program provided that farmers might be required, in order to earn maximum payments, to take such protective measures against erosion as were recommended by the State agricultural conservation committee and approved by the Agricultural Adjustment Administration.

When it was practicable for materials such as fertilizer, limestone, or seed to be furnished by the A. A. A. to participating producers for use in carrying out soil-building practices, the program provided that such materials might be furnished as grants to producers, and their cost to the Agricultural Adjustment Administration deducted from payments earned by the producers.

A complete list of soil-building practices under the 1938 program as announced April 16, 1938, is given in appendix A, along with rates of payment and deductions for nonperformance.

APPLYING THE NEW ACT TO THE SURPLUS CROPS

From the foregoing brief review of the 1938 Agricultural Conservation Program, and the understanding of the general terms of the act already outlined, it can be readily seen that the principal problem lay in applying the act to the surplus crops.

The situation as to cotton and tobacco farmers was especially difficult. The planting season was at hand, the dates for referenda on marketing quotas were set, and farmers were anxious for information as to how the act applied to their own farm work.

The Agricultural Conservation Program had to be adapted promptly to the acreage allotment provisions of the new act. The national allotments provided in the act for corn, cotton, wheat, and rice were determined on formulas worked out on the basis of the national supplies of the various commodities, and the probable demands for domestic consumption and exports. The formulas provide that these allotments shall be such as to produce, at the average yield for the 10 years preceding the making of the allotment, a supply of the commodity in question which would be adequate (1) to meet normal domestic consumption and export requirements during the following marketing year, and (2) to provide a reserve or carry-over supply of the commodity larger than the carry-over of past years had normally been. Such a supply assures consumers of enough of the crop at fair prices, in good years and bad, and assures producers of stocks on hand for sale at fair prices in good years and bad.

The allotments, as determined by the Secretary from the available statistics and forecasts, are distributed among States, counties, and individual farms in such manner as to assure participating producers an equitable share in the national production.

The acreage allotments are voluntary. Farmers who keep their plantings of the listed crops within the allotments made for their farms, thereby qualify for benefit payments made under the Agricultural Conservation Program. Deductions from these benefit payments, and loss of eligibility for maximum commodity loans and for parity payments, are provided for in cases of planting beyond the acreage allotments. No other payments or deductions from payments are provided for in connection with the acreage allotments. Acreage goals and allotments for crops other than the four specified were provided under the 1938 Agricultural Conservation Program.

The new act applied to cotton.—In the case of cotton, the act's provisions for acreage allotments and marketing quotas required rapid and important changes in the program.

The act applies directly to problems that continually face cotton growers. Some 10,000,000 farm people, on 2,000,000 farms in the South, depend on cotton as their chief source of income. So do several million other workers on railroads, in cotton gins, and in the textile mills. From one-third to one-half of the United States cotton crop usually is exported.

The act provided for announcement of the national cotton allotment for 1938 not later than 10 days after the approval of the act. The announcement is required not later than November 15 for sub-

sequent years. The new act required the national allotment to be expressed in terms of bales rather than of acres, and to be that amount of cotton which, together with the estimated carry-over as of August 1 after the announcement of the allotment, would make available a supply equal to a normal year's domestic consumption and exports, plus 40 percent as a carry-over.

Allotments for 1938 and 1939 were placed at not less than 10,000,000 bales and not more than 11,500,000 bales for each year. The national allotment for 1938 was anounced as 10,000,000 bales plus an indeterminate number of bales resulting from exceptions to the general formula for determining county and farm acreage allotments. In the act itself and in amendments soon adopted to it, these exceptions provided for adjusting the allotment upward.

As the act required, the national cotton allotment was apportioned among States on the basis of their production during the preceding 5 years, including in the calculation the production that would have been obtained from acreage diverted from cotton production under the agricultural adjustment and conservation programs. The number of acres then was determined that would be required, at average yields, to produce the number of bales in the allotment of each State.

State acreage allotments, in turn, were distributed among counties on the basis of previous acreages, provided that no county allotment of less than 60 percent of the 1937 acreage for that county was permitted. The national allotment could be adjusted upward to allow for this provision.

County allotments were distributed, through local and county committees, among individual farms. This distribution was made primarily on the basis of tillable acreage. In addition there were special provisions relating to allotments to small farms and for adjustment according to past production of cotton on the farm.

Preliminary State cotton acreage allotments for 1938 estimated according to this procedure were as follows:

	Acres		*Acres*
Alabama	2,244,000	Missouri	378,000
Arizona	197,000	North Carolina	1,002,000
Arkansas	2,402,000	New Mexico	111,000
California	389,000	Oklahoma	2,290,000
Florida	89,000	South Carolina	1,366,000
Georgia	2,126,000	Tennessee	826,000
Illinois	5,000	Texas	10,121,000
Louisiana	1,263,000	Virginia	60,000
Kansas	1,000		
Kentucky	20,000	Total	27,569,000
Mississippi	2,669,000		

While work went ahead on getting out the acreage allotments to individual cotton farmers, preparations were pushed forward for holding the referendum on the use of marketing quotas for cotton in 1938.

Cotton Marketing Quotas.—Cotton marketing quotas for individual farms consist of the yield—actual or normal, whichever is the larger—from the cotton acreage allotment established for the farm, in addition to any cotton grown in a previous year which might be

in the hands of the producer. That is, the farmer who has held his plantings within the acreage allotment for his farm is able to market without penalty all the cotton from that acreage. If he has exceeded his acreage allotment he is able to market without penalty as much cotton as was produced on his acreage allotment, or more if the actual yield was less than the normal yield from that acreage, in addition to cotton produced in a previous year but yet in the hands of the producer.

The penalty for marketing cotton in excess of the marketing allotment for the farm is 2 cents a pound. In future years the penalty will be increased to 3 cents per pound except on cotton grown in the year 1937–38.

Exemptions permit the marketing of cotton without penalty from farms on which less than 1,000 pounds of lint cotton is produced in 1938. Penalties, furthermore, do not apply to the marketing of cotton with a staple 1½ inches or more in length, or to the marketing of pure strains of Sea Island or American-Egyptian cotton which normally produces a staple 1½ inches or more in length.

Cotton producers received cards showing the amount of cotton which they are entitled to market without penalty, and cotton which they sell must be accompanied and covered by these cards. Penalties on excessive marketings of cotton are normally collected by the buyers, who may deduct such penalties from the purchase price of the cotton. Money so collected is turned over to the treasurer of the county agricultural conservation committee, and transmitted by the treasurer to the Secretary of Agriculture to be covered into the general funds of the United States Treasury.

Cotton Referendum Approves Quotas.—The cotton referendum was set for March 12 in an announcement made 1 day after the act was signed, and on the following day, February 18, the Secretary issued the formal proclamation provided for in the new act. This proclaimed that the total supply of American cotton for the marketing year 1937–38 would be 24,000,000 bales, whereas the probable domestic and export demands would total only 11,900,000 bales. The act provides that a cotton marketing quota shall be proclaimed when the total supply exceeds by 7 percent the normal supply which is equal to a normal year's domestic and export requirements plus 40 percent as a reserve. This normal supply for the marketing year 1937–38 is 18,200,000 bales. The actual total supply exceeded the normal supply by 6,300,000 bales, or nearly 35 percent.

In the producers' referendum on a cotton-marketing quota for the marketing year beginning August 1, 1938, votes were cast by 1,527,028 farmers in 19 cotton-producing States, out of probably 2,300,000 producers eligible to vote. The official returns from the referendum showed that 92.1 percent of the producers who voted cast their ballots in favor of the application of the quota.

Table 12 gives, by States, the number of producers voting, the "yes" and "no" votes, and the percentage in favor of the application of the quota.

TABLE 12.—*Summary, by States, of cotton-marketing quota referendum held March 12, 1938*

State	Number of votes cast			Percentage in favor
	Yes	No	Total	
Alabama	213,525	9,329	222,854	95.8
Arizona	1,230	214	1,444	85.2
Arkansas	134,754	4,580	139,334	96.7
California	2,908	1,483	4,391	66.2
Florida	6,921	1,433	8,354	82.8
Georgia	121,272	22,706	143,978	84.2
Illinois	238	20	258	92.2
Kansas	28	1	29	96.6
Kentucky	1,842	387	2,229	82.6
Louisiana	113,412	2,761	116,173	97.6
Mississippi	226,556	7,232	233,788	96.9
Missouri	12,731	724	13,455	94.6
New Mexico	1,787	428	2,215	80.7
North Carolina	127,965	15,534	143,499	89.2
Oklahoma	36,866	15,528	52,394	70.4
South Carolina	109,666	3,894	113,560	96.6
Tennessee	69,286	5,452	74,738	92.7
Texas	217,425	28,666	246,091	88.4
Virginia	7,676	568	8,244	93.1
Total	1,406,088	120,940	1,527,028	92.1

So on the basis of the referendum, the marketing quotas for cotton were approved for the marketing year 1938–39.

The new act applied to tobacco.—The act applies to six different kinds of tobacco, each divided into types, and each handled as a separate commodity because its problems differ from the problems of the other kinds. Signing of the act of 1938 created immediate problems of the application of its provisions, within a very limited time, to the problems of tobacco growers.

When the act was enacted a referendum on the use of marketing quotas for flue-cured, fire-cured, and dark air-cured tobacco was called for, and subsequent amendments resulted also in a referendum among producers of burley tobacco. The referendum on marketing quotas for flue-cured and dark tobaccos was set for March 12, the same date as the cotton referendum, and the referendum among growers of burley was set for April 9.

TOBACCO ACREAGE GOALS.—Acreage allotments for tobacco are not provided for by the Agricultural Adjustment Act of 1938. Instead, acreage goals for different kinds of tobacco were established for the 1938 Agricultural Conservation Program under the provisions of the Soil Conservation and Domestic Allotment Act. A national goal for each kind of tobacco was calculated, this was distributed among States on the basis of their past production, and the State goals were distributed among counties. The county goals were distributed, through local and county committees, among individual farms on the basis of past acreages, with adjustments for abnormal weather conditions, plant-bed and other diseases; land, labor, and equipment available for tobacco production; crop-rotation practices;

soil and other physical factors; and for equitable apportionments to new and small farms.

State acreage goals for tobacco were provided as shown in table 13.

TABLE 13.—*State acreage goals for tobacco*

State	Flue-cured	Burley	Fire-cured and Dark Air-cured	Cigar filler and binder
Massachusetts				4,906
Connecticut				12,060
New York				927
Pennsylvania				24,903
Ohio		16,900		19,092
Indiana		12,650	500	
Wisconsin				23,150
Minnesota				780
Missouri		6,900		
Kansas		500		
Virginia	91,500	12,800	26,300	
West Virginia		5,050		
North Carolina	590,000	9,650		
South Carolina	95,000			
Georgia	83,000			286
Florida	13,700			521
Alabama	500			
Kentucky		311,000	88,900	
Tennessee		76,100	55,100	
Total	873,700	451,550	170,800	86,625

TOBACCO MARKETING QUOTAS.—Marketing quotas for different types of tobacco, expressed in pounds, were provided for under the act, and quotas for three kinds of tobacco were put into effect in 1938. The act requires the Secretary to determine on November 15 of each year whether the total supply of each kind of tobacco at the beginning of the current marketing year exceeds the reserve supply of such tobacco. The reserve supply is defined in the act as an amount of tobacco 5 percent greater than the normal supply, which is equal to a normal year's domestic consumption and exports, plus 175 percent of a normal year's domestic consumption and 65 percent of a normal year's exports, as a normal carry-over. If the total supply does exceed the reserve supply level the Secretary must announce that fact not later than December 1, when a marketing quota for tobacco is proclaimed to apply during the marketing year which follows that in which the proclamation is made.

The national marketing quota is to equal the total quantity of tobacco which may be marketed during that marketing year in order to make available a supply equal to the reserve supply.

This national marketing quota is apportioned by the Secretary among the tobacco-growing States on the basis of their past production of tobacco, with necessary adjustments. Not more than 5 percent of the national marketing quota is held in reserve to be distributed among new producers and to be used in increasing the quotas of small farms. The act provides that no State's share of the national quota of flue-cured tobacco shall be less than 75 percent of that State's 1937 flue-cured tobacco production.

State marketing quotas are apportioned, through local committees, among individual tobacco farms on the basis of their past marketings of tobacco, and other factors affecting tobacco production. Provision is made for minimum individual farm quotas.

Tobacco marketed in excess of a marketing quota is subject to a penalty of 3 cents a pound for flue-cured, Maryland, or burley tobacco and 2 cents a pound for other kinds, or 50 percent of the market price of the tobacco if that sum is larger than the fixed penalties.

Marketing quotas for flue-cured and fire-cured and dark air-cured tobaccos in 1938 announced under the terms of the act on February 18, and for burley tobacco on March 28, to be effective during the marketing year, as finally determined according to the provisions of the amended act, were as follows: Flue-cured tobacco, 748,079,000 pounds; burley tobacco, 356,842,500 pounds; fire-cured and dark air-cured tobacco, 147,835,000 pounds. The act provided for certain increases in these quotas.

In the referendums on flue-cured and fire-cured and dark air-cured tobacco quotas, held March 12, the results were as follows: Flue-cured tobacco, 219,842 growers or 86.2 percent in favor, and 35,255 opposed; fire-cured and dark air-cured tobacco, 39,328 growers or 80.6 percent in favor, and 9,460 opposed. Producers from six States—Alabama, Florida, Georgia, North Carolina, South Carolina, and Virginia—voted in the referendum on the flue-cured quota. Producers in four States—Indiana, Kentucky, Tennessee, and Virginia—voted in the referendum on the dark tobacco marketing quota.

The referendum among 177,078 burley growers in 14 States showed 154,208 growers or 87.1 percent voting in favor of the quota, and 22,870 growers voting against.

The new act applied to corn.—The new farm act treats corn as a basic source of food for the Nation. It recognizes the importance of corn as a feed crop. About 88 percent of the corn crop is fed to livestock and reaches the consumer in the form of livestock products. Extreme swings in corn marketing upset the balance between feed supplies and supplies of livestock, and lead, within a season or two, to extreme fluctuations in supplies and prices of livestock products. The Ever-Normal-Granary provisions in the new farm act are very significant for corn and livestock producers because of their great potential value in stabilizing market supplies and prices of corn and livestock. The corn plan provided in the act is carried out through acreage allotments, loans on storage, and in emergency when the Ever-Normal Granary "runs over," through marketing quotas, if the growers vote 2 to 1 for them in a referendum.

Corn Acreage Allotments.—Corn acreage allotments under title III of the act were determined only for farms in the commercial corn area. Outside this area corn was included in the general soil-depleting crop acreage base for each farm. The commercial corn-producing area was defined in the Agricultural Adjustment Act of 1938 as including all counties where the average production of corn for grain during the 10 years preceding the announcement of an allotment, had been more than 450 bushels per farm, and more than 4 bushels for each acre of farmland in the county (with adjustment for abnormal

weather conditions). The commercial area is the Corn Belt and for 1938 was defined to include all of Illinois and Iowa; all except 15 counties in Indiana; 5 counties in southeastern Michigan; nearly all of southwestern and part of southern Minnesota; the northern two-thirds of Missouri; the eastern part of Nebraska, southeastern South Dakota and northeastern Kansas; 6 counties in southwestern Wisconsin, a large part of Ohio, and 4 counties in northern Kentucky.

The act required the Secretary to announce the national corn acreage allotment for 1938 as soon as possible after the approval of the act, and the allotments for subsequent years not later than February 1 of each year. It set the corn marketing year as the 12 months beginning October 1.

On March 21, about 5 weeks after the act was signed the Secretary of Agriculture announced a corn acreage allotment of 40,491,279 acres for the commercial area. This was in line with the national corn acreage goal of 94,000,000 to 97,000,000 acres under the Agricultural Conservation Program. The acreage allotment was calculated to produce in the commercial area enough corn, when added to that carried over from the previous year and that which it was expected would be produced outside the commercial area, to give a total supply equal to 110 percent of a normal year's domestic consumption and exports. The additional 10 percent allowed for a carry-over about double the usual carry-over of normal years.

This acreage was apportioned by the Secretary among the counties in the commercial area and, through the local and county committees, to individual farms after consideration of each farm's tillable acreage, crop-rotation scheme, soil type, and topography. The county apportionments gave the following distribution of the national allotment among States in the commercial area:

	Acres		*Acres*
Illinois	7, 348, 375	Minnesota	3, 319, 794
Indiana	3, 456, 203	Missouri	3, 267, 079
Iowa	9, 249, 232	Nebraska	6, 757, 334
Kansas	2, 108, 595	Ohio	2, 521, 771
Kentucky	150, 507	South Dakota	1, 635, 790
Michigan	223, 790	Wisconsin	452, 809

Corn Marketing Quota.—The act requires the Secretary to determine and proclaim, not later than August 15 of each year, the probable total supply of corn as of the following October 1, and whether that total supply, including the carry-over, will exceed by more than 10 percent the "normal supply" which is equal to a normal year's domestic consumption and exports, plus 7 percent as a normal carry-over. The August crop reports and other official statistics are to be used in the determination.

If the total supply as to October 1 is estimated at more than 10 percent above the normal supply, marketing quotas for the commercial corn-producing area are to be announced for the following marketing year, beginning October 1, subject to a referendum of growers in the commercial area.

In conformity with the foregoing, the Secretary proclaimed that the probable total supply on October 1 would not exceed the normal supply by more than 10 percent, that marketing quotas would not be required on the 1938 crop, and that no referendum on corn quotas in 1938 would be necessary.

The new act applied to wheat.—The new farm act recognizes that the wheat farmer faces two chronic dangers. One is the risk of crop failure. This overtook him with successive short crops from 1933 to 1936. The other is the danger of tremendous surplus. Accumulation of successive surpluses without export outlets buried the farmer in 1932 under a mountain of 35-cent wheat, and at the time the act was passed, wheat supplies were again large.

The national wheat acreage allotment, to be announced each year not later than July 15, is defined by the act as the acreage which at average yields will produce, with the carry-over from the previous year, not less than 130 percent of a year's normal domestic consumption and export requirements. The 30 percent over the requirements would represent a reserve supply more than double the average carry-over of normal years, and would be available to meet new export markets or to maintain market supplies in years of short crops.

Plans had been made by the Agricultural Adjustment Administration during the summer of 1937 to set up a separate acreage goal for wheat similar to that prepared and later set up for cotton, but these plans were altered after a conference with wheat growers themselves held at Washington on July 1 and 2, 1937. In this 2-day conference with representatives from 31 wheat States concerning the wheat provisions of the 1938 Agricultural Conservation Program, it was decided to include wheat in a general soil-depleting acreage group rather than set up a special wheat acreage goal for wheat only.

Since much of the wheat for harvest in 1938 had already been seeded at the time of the approval of the act, and seeding had been planned with no separate goal for wheat in mind, it was provided that the acreage allotment for 1938 harvest set up by the act should be used only as a basis for calculating benefit payments and that it should be 62,500,000 acres.

Actual seeded wheat acreage for harvest in 1938 was again not far from 80,000,000 acres, and it early became apparent that the probable supply would be so large that if the 1939 allotment were figured according to the formula in the act, wheat allotment acreage for harvest in 1939 would probably be not more than 46,000,000 acres, a reduction of more than 40 percent from the 1936 and 1937 acreages.

In order to avoid the necessity for this extensive reduction, the amendment that was passed and approved on June 20, 1938, provided that the wheat acreage allotment for 1939, under which producers would be able to qualify for benefit conservation payments, would be not less than 55,000,000 acres.

The allotment of 62,500,000 acres for 1938 was apportioned on April 13, 1938, among States on the basis of average seedings for the preceding 10 years. The apportionment among States was as follows:

	Acres		*Acres*
Alabama	5, 710	Kansas	12, 519, 879
Arizona	35, 375	Kentucky	382, 542
Arkansas	77, 060	Maine	6, 047
California	708, 656	Maryland	395, 014
Colorado	1, 504, 623	Michigan	765, 831
Delaware	77, 489	Minnesota	1, 609, 218
Georgia	139, 664	Mississippi	84
Idaho	1, 011, 604	Missouri	1, 938, 358
Illinois	2, 039, 411	Montana	3, 973, 939
Indiana	1, 689, 970	Nebraska	3, 466, 075
Iowa	456, 037	Nevada	13, 147

	Acres		Acres
New Jersey	52, 990	Tennessee	381, 981
New Mexico	356, 665	Texas	4, 148, 240
New York	246, 779	Utah	239, 656
North Carolina	413, 024	Vermont	118
North Dakota	9, 431, 355	Virginia	546, 728
Ohio	1, 870, 407	Washington	1, 912, 506
Oklahoma	4, 291, 784	West Virginia	130, 091
Oregon	867, 859	Wisconsin	108, 001
Pennsylvania	873, 098	Wyoming	343, 971
South Carolina	125, 611		
South Dakota	3, 345, 403	Total	62, 500, 000

Wheat Marketing Quotas.—The act provides for marketing quotas for wheat, after the marketing year beginning July 1, 1938, based on the same general considerations of supply and demand as are the quotas for other crops. It requires that the Secretary shall determine not later than May 15 the total United States supply of wheat as of the beginning of the next marketing year. This supply is to include the anticipated production and the carry-over from the previous marketing year. If this supply should exceed by as much as 35 percent a normal year's domestic consumption and export requirements, a national marketing quota would be proclaimed for the following marketing year. This quota would not become effective if opposed by more than one-third of the producers affected who voted in a referendum held before June 10.

This national marketing quota would be expressed both in terms of bushels and in terms of the number of acres which, at average national yields, would produce the number of bushels in the quota. The quota would be the number of bushels equal to a normal year's domestic requirements and exports, plus 30 percent, less the carry-over from the preceding year and less the amount of wheat which would be estimated as being required on farms for seed or as feed for livestock during the marketing year.

Crop insurance for wheat.—Insurance to wheat growers on their yield, beginning with wheat harvested in 1939, is provided for under title V of the Agricultural Adjustment Act of 1938. This legislation created the Federal Crop Insurance Corporation as an agency of the Department of Agriculture, to administer the crop-insurance plan. While limited to wheat under existing legislation, the plan may be adapted and applied later to other commodities.

Premiums and losses under the crop-insurance plan are calculated in terms of bushels of wheat. Payments of either may be made either in wheat or in cash. The Corporation uses cash paid as premiums to purchase wheat at the current market price. It may also sell wheat in order to meet claims for cash indemnities. The corporation maintains its reserves in actual stored wheat and is not authorized to buy or sell wheat on the market for any purpose other than to add premium wheat to its reserves, pay claims for losses of producers, or to prevent deterioration or to change the location of stored wheat reserves.

The effect of making premiums and claims payable in terms of bushels of wheat is to provide growers with insurance on their yields, but not on their price, and to stabilize in a measure the marketing of wheat.

In good wheat years wheat will accumulate in the reserves of the Corporation, as it is paid in in premiums. This will tend to divert from the regular market channels a certain portion of an unusually large crop and thus strengthen the market price. It is estimated that the insurance reserve may eventually reach a level of from 50,000,000 to 100,000,000 bushels.

In bad wheat years when losses are heavy wheat will be paid out to producers who have suffered losses and who will market the wheat, thus increasing the market supply to the advantage of consumers.

While the net cost of the insurance is borne by insured producers who contribute in premiums the wheat that is stored as a reserve and later paid out in settlement of losses, the expense of administering the plan and storing the wheat reserves is borne by Government funds and the Corporation is provided with a capitalization of $100.000.000 representing stock held by the Government, of which $20,000.000 has been subscribed to be available if required to pay heavy losses before the accumulation of a reserve in wheat paid in as premiums.

Insurance coverage may be for either 50 percent or 75 percent of the average yield for the farm, at the choice of the grower, under certain stipulations by the Corporation. Insurance premiums for individual farms are calculated on the basis of average yields and average losses on the farm during the 6-year period 1930–35, adjusted according to the experience in the 10-year period 1926–35, and also adjusted in relation to yield and loss averages for other farms in the same county. The minimum rate would be 0.5 bushel per acre for a coverage of 75 percent of the average yield and 0.3 bushel per acre for coverage of 50 percent of the average yield.

Tentative rates have been calculated, on the basis of statistics on past yields and losses, for all important wheat-growing counties. These rates range upward from the minimum given above. Statistics collected in the operation of agricultural adjustment and conservation programs are used in calculating average yields and premium rates.

The crop-insurance plan is administered through State and county agricultural conservation committees and the Agricultural Extension Service, with a supervisor appointed for each State. Headquarters of the Corporation are at Washington, with one branch office at Minneapolis, Minn., and another at Kansas City, Mo.

The new act applied to rice.—Rice Acreage and Domestic Consumption Allotments.—The new act requires that each year before December 31 the Secretary shall determine and proclaim the national and State acreage allotments for rice and the allotments to be in effect for the following crop year. The national acreage allotment is to be that acreage which, at the average yield of the preceding 5 years, would produce a normal year's domestic consumption and exports of rice, plus 10 percent as a carry-over.

The national allotment is distributed by the Secretary among the rice-producing States on the basis of their previous acreages. In each State the State allotment is thereupon distributed through local and county committees among rice growers, 3 percent of each State allotment being reserved to be distributed among new producers. The distribution of allotments among producers is based upon past

production, crop-rotation practices, soil fertility, and other physical factors affecting the production of the crop.

In addition to the acreage allotment the act requires the Secretary to establish and proclaim the total amount of rice which will be needed during the next marketing year to meet the requirements of consumers in the United States. This domestic allotment is then apportioned among States in proportion to the average production of a 5-year period, and the State allotments among rice growers on the basis of the yields of their acreage allotments.

State rice acreage allotments for 1938 were announced by the Secretary on April 28, 1938, as follows:

State:	*Acres*
Arkansas	155,728
California	105,094
Louisiana	421,396
Missouri	510
Texas	167,272
Total	850,000

Rice Marketing Quotas.—The Agricultural Adjustment Act of 1938 prohibited the application of marketing quotas to rice in the marketing year beginning August 1, 1938. It provided that in later years, if the total available supply of rice exceeds by more than 10 percent the normal supply, which is a normal year's domestic consumption and exports plus 10 percent, that fact shall be proclaimed at the time of the proclamation of the national rice acreage allotment, and a national marketing quota will be in effect, subject to a referendum of growers, during the following marketing year.

A rice marketing quota would be the amount of rice required to make available, during the marketing year, a normal supply of rice.

This national quota would be apportioned among producers on the same basis of production on which the domestic allotment of rice would be apportioned among them. Rice producers marketing rice in excess of their quotas would be subject to a penalty of 0.25 cent for each pound so marketed.

LOANS AND THE EVER-NORMAL GRANARY

Loans to farmers to enable them to hold their crops, an important measure of protecting them against sudden price declines, become under the new farm act an essential instrument in carrying out the Ever-Normal Granary for corn, and one means of establishing an Ever-Normal Granary for wheat.

The Ever-Normal Granary means increased reserve supplies of these two crops, going into storage in time of surplus production, for use in short-crop years. The new farm act modified and extended the commodity loan program.

Loans on agricultural commodities.—In continuation of the practice which had been followed since 1933 the Federal Government, through the Commodity Credit Corporation, has made loans to producers of certain agricultural commodities, on the security of the stored commodities themselves, in 1937 and 1938.

One purpose of these loans has been to put a plank under prices of farm products when these prices were too greatly depressed by

oversupplies on markets. Another purpose has been to enable farmers to carry over from a good year supplies not immediately required for consumption, and thus have those supplies available in years when crops are short. This carrying over is designed (1) to help maintain for consumers an adequate supply of the commodities in question at fair prices and (2) to help stabilize farmers' incomes from these commodities by avoiding alternate oversupplies and scarcities with consequent severe price fluctuations.

Table 14 gives data as of June 30, 1938, on commodity loans made through the Commodity Credit Corporation, either approved since January 1, 1937, or outstanding at some time since that date. Information on loans in previous years has been given in previous reports. The rate of interest on all these loans is 4 percent per annum.

Loans under the new farm law.—The Agricultural Adjustment Act for 1938 authorized such loans through the Commodity Credit Corporation on any agricultural commodity, including dairy products, and specifically directed the Corporation to make loans on cotton, corn, and wheat under supply and price conditions laid down in the act itself. In addition to stipulations as regards rates at which these loans should be made, the act provided that there should be variations and adjustments in these rates on the basis of variations in the grades and qualities of the commodities which were security for the loans.

TABLE 14.—*Data on commodity loans approved since Jan. 1, 1937, or outstanding at any time within that period, by commodities produced in years specified*

Commodity and year produced	Date loan was approved	Date of maturity of loan	Rate of loan
Cotton:			
1934–35	Sept. 11, 1934	Feb. 1, 1936	12 to 11 cents per pound.[1]
1935–36	Sept. 9, 1935	July 31, 1936	10 to 9 cents per pound.[1]
1937–38	Aug. 30, 1937	July 31, 1939	9 to 6 cents per pound.[1]
Corn:			
1936–37	Oct. 30, 1936	June 1, 1937	55 cents per bushel.
1936–37 [2]	Oct. 26, 1936	Apr. 1, 1937	$1.75 per bushel.
1937–38	Dec. 3, 1937	Extended indefinitely	50 to 44 cents per bushel.[3]
Tobacco:			
1931–35 [4]	June 27, 1936	Demand notes	Averaged 12.32 cents per pound.
1937–38	Feb. 19, 1938	do	Averaged 16.42 cents per pound.
Turpentine and rosin:			
1934	July 27, 1934	May 1, 1935	Averaged 46.4 cents per gallon of turpentine and $4.455 per barrel of rosin.
1938	Apr. 2, 1938	Feb. 1, 1939	Averaged 21.2 cents per gallon of turpentine and $10.40 per barrel of rosin.
Dates	Oct. 13, 1937	Demand notes	4 cents per pound.
Figs	Sept. 16, 1937	do	1½ cents per pound.
Prunes	Nov. 1, 1937, and Oct. 19, 1937.	do	2 cents per pound.
Raisins	Mar. 4, 1938	do	$55 per ton.
Wool and mohair	Apr. 13, 1938	May 31, 1939	Averaged 17.55 cents per pound.
Butter	June 9, 1938	Demand notes	Averaged 24.8 cents per pound.
Peanuts	Oct. 4, 1937, and Oct. 19, 1937.	do	Averaged 3 cents per pound.

[1] Rates on cotton loans varied according to the grade and staple of the cotton offered as security.

[2] Two loans on corn grown in 1936 were made. One was on corn for feed, and was at the rate of 55 cents per bushel. The other, announced Oct. 26, 1936, was on corn of quality suitable for seed, and was at the rate of $1.75 per bushel. Disbursements under both loans are combined in this table.

[3] This rate varied according to the moisture content of the corn stored as collateral.

[4] These loans were made originally by the Reconstruction Finance Corporation and the outstanding balances were purchased by the Commodity Credit Corporation from the Reconstruction Finance Corporation as of June 30, 1936.

TABLE 14.—*Data on commodity loans approved since Jan. 1, 1937, or outstanding at any time within that period, by commodities produced in years specified*—Continued

Commodity and year produced	Amount disbursed	Repayments and notes charged off	Balance outstanding
Cotton:			
1934–35	$303,434,803.48	$187,442,854.20	$115,991,949.28
1935–36	3,655,821.76	3,631,358.97	24,462.90
1937–38	105,364,756.05	1,419,201.58	103,945,554.47
Corn:			
1936–37	46,031.82	46,031.82	
1936–37 [2]			
1937–38	7,159,968.99	165,268.42	6,994,700.57
Tobacco:			
1931–35 [4]	8,592,845.37	3,883,950.11	4,708,895.26
1937–38	165,116.12		165,116.12
Turpentine and rosin:			
1934	7,261,386.39	5,851,790.95	1,409,595.44
1938	4,038,837.13	1,199.91	4,037,637.22
Dates	61,302.00	19,952.40	41,349.60
Figs	83,914.91	83,914.91	
Prunes	2,357,068.91	919,752.35	1,437,316.36
Raisins	966,416.27		966,416.27
Wool and mohair	555,024.97	7,878.21	547,146.76
Butter	290,912.15		290,912.15
Peanuts	5,359,000.53	4,785,210.48	573,790.05
Total	449,393,206.96	208,258,364.31	241,134,842.65

See footnote on p. 119.

Amounts, terms, and conditions of loans offered to producers of agricultural commodities other than cotton, wheat, and corn, are to be determined by the Secretary of Agriculture with the approval of the Commodity Credit Corporation and of the President. No loans on cotton, corn, wheat, or rice may be offered to producers during a marketing year in which supplies of either of these commodities have reached levels at which the application of a marketing quota is authorized under the act, if a referendum on such a marketing quota has resulted in an unfavorable vote of the producers and if the quota has thereby been rendered ineffective. This provision is designed to protect the value of the commodity which constitutes the security for the Government loan, since unregulated and burdensome marketing would tend to force down the price of the commodity.

WHEAT LOANS.—The Commodity Credit Corporation is directed to offer loans to wheat producers under conditions defined in the act. The loans are to be offered to cooperators in the Agricultural Conservation Program who hold their wheat plantings within the acreage allotments established for their farms, by title III of the act, on terms different from those offered to noncooperating producers.

Loans are to be offered to cooperating producers: (1) In any marketing year beginning in a calendar year in which the farm price of wheat on June 15 (or thereafter during the marketing year) goes to less than 52 percent of the parity price; or (2) in any marketing year in which the July crop estimate for wheat indicates a crop in excess of a normal year's domestic requirements and exports. Rates of such loans are to be not less than 52 percent and not more than 75 percent of the parity price of wheat on July 1, the beginning of the marketing year.

Loans are to be offered to noncooperating producers only in years when marketing quotas for wheat are in effect, and then only on so much of their crop as, under the marketing quota, would be subject to a penalty if marketed. The rate of loans to noncooperators is to

be not more than 60 percent of the rate of loans to cooperators in the conservation program.

Corn Loans.—The Agricultural Adjustment Act lays down in detail the conditions for offering loans on corn. Different conditions apply to producers who comply with the allotment prescribed by the act for the commercial corn area, and to those producers who do not. For producers outside the commercial corn-producing area, eligibility for loans is conditioned on not exceeding the soil-depleting base established under the Soil Conservation and Domestic Allotment Act.

To cooperating producers within the commercial corn-producing area loans are to be offered: (1) During any marketing year beginning in a calendar year in which the November crop estimate indicates a crop in excess of a normal year's domestic requirements and exports; or (2) in any marketing year when on November 15, or thereafter, the farm price of corn goes below 75 percent of the parity price.

These loans are to be offered at rates determined by national supply and price factors, as follows:

At 75 percent of the parity price if the November crop estimate does not exceed a normal year's domestic consumption and exports, but the farm price of corn is below 75 percent of the parity price on November 15, or at any time thereafter during that marketing year.

At 70 percent of parity price if the November estimate exceeds the normal year's requirements by not more than 10 percent.

At 65 percent of parity price if the estimate exceeds the normal year's requirements by more than 10 and not more than 15 percent.

At 60 percent of parity price if the estimate exceeds the normal year's requirements by more than 15 and not more than 20 percent.

At 55 percent of parity price if the estimate exceeds the normal year's requirements by more than 20 and not more than 25 percent.

At 52 percent of parity price if the estimate exceeds the normal year's requirements by more than 25 percent.

To corn growers in the commercial area who are not cooperating in the conservation program, loans are to be made only in years when a marketing quota is in effect for corn, on only that portion of their crop which the marketing quota requires shall be stored, and at only 60 percent of the rates for cooperating producers.

To corn growers outside the commercial area who are cooperating in the conservation program, loans are to be offered at 75 percent of the rates for cooperators within the area. Marketing quotas for corn do not apply outside the commercial area.

Cotton Loans.—Provisions of the act with regard to loans to cotton producers distinguish between growers complying with the acreage allotments set up by the act and those who are not complying. It directs that loans shall be offered to cooperators during any marketing year in which the average price of 7/8-inch middling cotton on the 10 designated spot markets goes below 52 percent of the parity price. The rates of these loans are to be not less than 52 percent and not more than 75 percent of the parity price as of August 1, the beginning of the marketing year for cotton.

Cotton growers who are not complying with the acreage allotments set up by the act are to be eligible for loans only in years when cotton marketing quotas are in effect, and then only on that portion

of their crop which cannot be marketed except under the penalty provided for by the marketing quota, and at rates equal to 60 percent of the rates offered to cooperators.

LOCAL ADMINISTRATION BY FARMERS

The new farm act wrote into law the practice which had been followed since 1933 of depending upon farmers themselves for local administration of the program.

Agricultural adjustment legislation previous to the Agricultural Adjustment Act of 1938 authorized the Secretary of Agriculture in administering such legislation to utilize the assistance of local, county, and other committees and associations of farmers who were participating in the program. From 1933 onward, the assistance of these groups was used in local administration of the national programs. Farmer committeemen and associations recommended measures for the program, and modifications of the program, with reference to the conditions and needs of their own localities. They also took part in carrying out the programs in their own areas.

The Agricultural Adjustment Act of 1938 crystallized this principle of local assistance in administration by requiring the Secretary to designate local administrative areas, by prescribing that cooperating producers in those areas shall elect local and county committees from among their own number, and by requiring that certain administrative functions, notably the apportioning of county acreage allotments among individual farms, shall be carried out through the local and county committees.

The act also specified the manner in which the local committees, of not more than three members each, shall be elected by the cooperating farmers, and the manner in which county committees shall be chosen. Because of the fact that by the date of the approval of the act the 1938 Agricultural Conservation Program was already under way and local and county committees chosen under its provisions were already functioning, the act provided that the committees already chosen should function through 1938.

For 1939 and thereafter the county committees, each of not more than three farmer members, are to be elected at a county convention by local delegates chosen by cooperating farmers in the administrative areas at the same time as the local committeemen are chosen.

County agricultural extension agents are to be ex officio members of the county conservation committees unless they are elected to serve as their secretaries, but may not vote.

The act provides that in each State there shall be a State agricultural conservation committee of not fewer than three and not more than five farmer residents of the State, appointed by the Secretary of Agriculture. In addition, each State director of agricultural extension is ex officio a member of his State committee.

Local and county committeemen carry a large share of the administrative work connected with the program in their counties and areas. Their recommendations are required in the apportionment of acreage allotments, the approval of certain soil-building practices, the requirements as to protecting soil from erosion, and the checking and approval of applications for benefit payments under the conservation, loan, and other programs.

CHAPTER 4

OBJECTIVES IN AGRICULTURAL ADJUSTMENT POLICY

Important developments in the relations between the Federal Government and agriculture before 1933 were reviewed in the first chapter of this report. Next, the provisions of successive farm legislation which began with the original Agricultural Adjustment Act were summarized in chapter 2. Finally, in chapter 3, the operations of the Agricultural Adjustment Administration under these various acts were summarized briefly for the period preceding January 1, 1937, and described in more detail for the period since that date.

These chapters have told what has been done. This chapter will set forth the basic ideas which underlie the agricultural adjustment policy as a whole, and will describe the objectives sought through that policy.

In this chapter the objectives of the adjustment program are considered as they relate to: (1) Conditions and events leading up to the adjustment legislation, (2) the provisions of the legislation enacted, (3) the attitude of those charged with its administration, and (4) the nature of the activities carried out. In succeeding chapters a preliminary appraisal is made of actual progress toward the objectives. Finally, in a concluding chapter an attempt is made to express the policy reflected in the program during the past 5 years.

I. EMERGENCY FACTORS DOMINATED EARLY OBJECTIVES

The first adjustment programs were launched in a period of acute depression. For agriculture this depression had begun in 1921, but it did not seriously affect other industries until late in 1929. From then on it spread rapidly, and by the spring of 1933 agriculture and the entire Nation were faced with an economic emergency unprecedented in American history.

Agricultural prices had fallen sharply in 1921. The events of 1929 started a further decline. Demand for farm products fell off rapidly both at home and abroad, while farm production continued at a high level and in some lines even increased. As a result, by 1932 prices of farm products had dropped to record lows. Thousands of farmers had lost their farms, and many others whose farms were mortgaged faced the prospect of losing their equities.

Almost from the beginning of the farm depression in 1921, widespread demands for governmental aid to farmers arose. Various proposals for such aid were advanced. During the years of discussion and agitation which followed, a public attitude in favor of some positive Government program for farm aid was gradually developing. Appar-

ently, however, this attitude was not centering on any one specific plan of action. Farmers themselves were divided over the question of what measures should be employed to provide the help which nearly all felt to be necessary, and each of the large general farm organizations was sponsoring a different plan.

In 1927 and 1928 Congress twice passed the McNary-Haugen bill, but each time this legislation was blocked by a Presidential veto. Following this double defeat of the plan which had acquired the greatest measure of political support, sponsors of the various farm-relief proposals apparently concluded that it was not yet possible to obtain enactment of any one of the plans in which they were most interested. As a result, some farm groups supported and none of the general farm organizations actively opposed a trial of the Farm Board plan embodied in the Agricultural Marketing Act of 1929.

This experiment broke down under the extremely adverse conditions of the time. In Congress and among representatives of the major farm groups, the idea of developing an emergency plan gained headway. It was hoped that this emergency relief might serve during a period in which they could compose their differences and work out a permanent plan that all could support. Consequently, under the added stimulus of rapid declining prices and incomes, and under the leadership of the new national administration, the various agricultural spokesmen accepted and supported the agricultural adjustment legislation with its promise of an immediate attack upon the farm problem.

This first adjustment legislation was designed to meet the national economic emergency. It was based upon a frank recognition of the economic conditions in agriculture which were impoverishing farmers and impeding general business activity. These circumstances necessarily dictated the immediate objective of the act and of the program through which it was carried out.

This objective was the enhancement of farm income and purchasing power in order to relieve farm distress and hasten recovery from the national economic crisis. Both this objective and the broad purpose underlying it were stated briefly but comprehensively in the title of the whole statute of which agricultural adjustment made up one part, and the first section of which was headed "Declaration of Emergency."

The program through which the provisions of the Adjustment Act was carried out sought to bring about a substantial redistribution of the national income as between farmers and other groups. To this end the various activities described briefly in the preceding chapter of this report were undertaken by the Agricultural Adjustment Administration. The theory underlying those activities may be stated quite clearly.

First, it was expected that the adjustment programs, by restoring better balance between supply and demand for farm products, would increase farm-buying power and thus stimulate general economic recovery. The result of this general economic improvement would naturally be an increase in the total national income. In the second place, it was expected that farmers would receive a larger share of this increased national income. In other words, as Secretary Wallace

has often informally expressed it, the agricultural policy sought to obtain for farmers "a larger piece of a bigger pie."

The payments to farmers were to be not only a direct contribution to farm income, accomplishing in themselves a partial redistribution of national income, but they were to be paid in such a way as to help farmers restore a better balance between supply and demand for their products. This better balance, in turn, would serve to stimulate the general economic activity which was necessary if the national income was to be increased.

Prominent in the program were the commodity-adjustment plans. Under these plans, sizable income supplements in the form of benefit payments were made available for the immediate relief of farmers. By financing these payments through processing taxes, and by conditioning them upon limitation of acreage and production, part at least of the cost of this relief was transferred to the market in the form of higher prices.

In their application to certain basic commodities, the commodity-adjustment plans were supplemented by such measures as Government purchases, commodity loans, marketing agreements, and penalty taxes upon production in excess of allotments, in order to assure their immediate effectiveness in raising farm prices and incomes. For other commodities, marketing agreements and licenses, purchases for relief distribution, and diversion plans were developed. All these activities were directed toward the same broad objective of income improvement for farmers.

In some instances this objective was sought mainly through regulation of prices. More typically, however, the approach was through regulation of supplies. It included in some instances the restriction of acreage and production or the limitation of marketing; in others the removal of supplies already on the market, through relief purchases or diversion to noncompetitive outlets such as export or by-product uses; and in still others a control over the distribution of supplies within the season, among markets, or among uses.

Thus, in its first phase the program was designed primarily to increase the incomes of individual farmers. The payment of cash benefits was a direct approach to this end. But for enlarging and maintaining these gains chief emphasis was placed upon eliminating surpluses, raising prices, and stimulating national economic activity. In order to set up a definite administrative goal, the price objective was defined in the law as the level which would give farm commodities a purchasing power in relation to other commodities equal to what they had had in a base period—in other words, "parity price."

II. FIRST OBJECTIVES MODIFIED BY DROUGHT

The early adjustment plans were swiftly modified in 1934 as a result of the great drought, which had disastrous effects on yields of all crops over a large area. In comparison with the effects of the drought, the adjustments which had been planned through the programs were small. Carry-overs of wheat and other grains were reduced until wheat sold on a domestic-price basis rather than on a world-price basis. Because of the shortage of feed, livestock numbers

were so drastically cut that supplies of pork and beef for 1935 were much smaller than in previous years. Meat prices rose to levels which brought complaints from consumers. Prices of milk, eggs, and butter also were strengthened. Thus within one season drought caused an adjustment in the supplies of farm products far more sweeping than any remotely suggested by any phase of the adjustment program.

The drought adjustment, however, was far from satisfactory. Although prices were now at the higher levels that had been sought, farm income did not increase comparably with prices. Producers in the drought areas lost such a large part of their crops and livestock that in many cases they had virtually nothing to sell at the high prices prevailing. Under these circumstances the cash benefit payments provided by the program were highly important as actual relief from a disastrous loss of income.

To meet the new conditions caused by the drought, emphasis upon income enhancement was continued but much greater attention was given to providing a controlled expansion of the output of foods and feeds which had been too much reduced by the drought. At the same time the Agricultural Adjustment Administration and other Government agencies undertook an extensive cattle-purchase program and other large-scale drought-relief activities. Besides salvaging livestock which otherwise would have been lost, and conserving existing supplies of feed, these emergency measures supplemented the cash benefit payments and saved many farmers in the drought areas from being made destitute.

III. LONGER-TIME OBJECTIVES EMERGE

The character of the program in its first 2 years of operation was influenced largely by these emergencies. In a similar way, emergency considerations likewise shaped the program in succeeding seasons. Such influences have been highly important in determining the activities undertaken in almost any given period. But these activities were also important as intermediate steps toward long-time objectives of a more fundamental nature.

THE EARLY OUTLOOK REPORTS

Prominent among the long-time objectives are permanent improvements in systems of farming. This objective began to emerge even in the first phase of the program. It had not originated with the Agricultural Adjustment Act, but, on the contrary, was already well established in earlier efforts by Federal and State agencies to develop extensive informational services and programs of educational guidance to help agriculture make a larger contribution to national well-being. The character of this long-time objective is seen most clearly in the agricultural outlook work which began in 1922 and has since been conducted by the Department of Agriculture and the various State agricultural colleges, and which was intended to help farmers solve the problem of what and how much to produce.

Early outlook reports emphasized the importance of maintaining production at an annual level which would result in satisfactory prices. Hence, analyses of commodity situations were projected to

indicate what prices might be expected in the succeeding season, in the hope that farmers would be influenced to adjust their production plans accordingly. This procedure was a direct approach to the problem of maintaining a suitable balance between total supplies and demand through educational guidance.

As the work continued, however, it became apparent that farmers were not making the indicated adjustments in sufficient numbers to bring about the desired ends. When formulating their production plans, individual producers were influenced by considerations other than the price outlook. For instance, the tendency to maintain fairly stable rotations and crop combinations restricted farmers' year-to-year changes in line with price outlook. This fact, together with conclusions reached by farm-management research, seemed to indicate that adapting systems of farming to particular local conditions represented a more important aspect of production adjustment than did year-to-year changes in response to market conditions.

In line with this indication, attempts were made to refine the annual outlook analysis so as to make it more applicable to regional and local conditions. More attention was given to basic trends which should be taken into account in establishing a permanent system of farming, and less importance was attached to forecasting the marketing situation for the following season. In addition, an effort was made to coordinate the outlook material with other educational activities.

THE EARLY PROGRAM PLANNING EFFORTS

In some localities such activities became the nucleus for the development of local agricultural programs through which farmers, extension workers, and others collaborated in working out the long-time adjustments which seemed to be needed in their communities, and in focusing educational efforts on the problem of getting farmers to make these adjustments. These programs represented the most advanced stage so far attained in agricultural adjustment through educational guidance and voluntary farmer cooperation. They were pioneer efforts in program planning. They promised to become more effective than any previously attempted method for bringing the information of the Department and the State colleges to bear directly upon the farmer's problem of achieving an efficient system of farming over a period of years.

Although the information available was generally somewhat inadequate for intensive local application, it was possible to actually formulate constructive plans. However, it was exceedingly difficult for farmers to make voluntary adjustments called for by the plans, and it became apparent that broader and more direct assistance was needed.

The voluntary domestic-allotment plan was suggested as a means for making the plans effective if it could be modified to make the direct benefits to farmers conditional upon their willingness to make prescribed adjustments in their production. From this point of view, the production-control feature of the plan would protect income benefits by preventing offsetting increases in production. The payments thus would become extremely important in that they would identify

individual advantage with group advantage, and make it pay more to cooperate than to refuse to cooperate. They would become, in fact, the economic mainspring that had been lacking from all the usual cooperative programs. They would offset the loss of income due to cooperation, and make it profitable to adjust and to conserve rather than to sacrifice long-time gains for the sake of immediate volume production.

OBJECTIVES OBSCURED BY EMERGENCIES

When the adjustment program was finally authorized, however, this general idea of promoting long-time internal adjustments in agriculture was largely submerged by emergency considerations. Under the conditions which developed after 1929, the low prices and excessive accumulations of supplies were viewed as the problem of greatest importance, and for the time being attention was directed very largely to the matter of adjusting total production downward, thereby abruptly halting the previous trend toward a more permanent adjustment based on improved systems of farming.

But although submerged temporarily, the long-time objective was by no means eliminated as a factor in the evolution of farm policy. The emergency emphasis was necessary under the conditions which prevailed, but it was not in any sense regarded as an abandonment of long-time principles. Even within its first year of operation the Agricultural Adjustment Administration program was administratively viewed as an immediate step toward a more permanent program which was already under consideration.

Such considerations were increased in 1934, although again they were obscured by the drought emergency. After the drought, with surpluses substantially reduced and incomes at a higher level, it became possible in 1935 to study the adjustment programs in order to see how they might be modified for permanent use. This move represented a shift in objectives, not so much through the dominance of new ideas as through the reappearance of long-time ends which necessarily had been subordinated during the period of emergency.

At this stage several conclusions seemed to be apparent from the experience already gained. It was observed that the distribution of benefit payments out of processing taxes offered an effective means for getting farmers throughout the country to cooperate in making the needed adjustments. Even the first programs had significant effects in this direction, since many of the acres taken out of production were planted to grasses, legumes, and other cover crops that were good for the land and desirable from a long-time point of view.

Work that had been done in the Department of Agriculture and in various agricultural experiment stations indicated that if a large majority of farmers carried these changes to the extent approved by good farm management, a solution of the problem of adjusting total production would be in sight. Moreover, this more diversified system of farming would be less affected by year-to-year variations in weather conditions, and hence production would be correspondingly more stable. Also, it would bring about a more efficient use of the Nation's land resources and would protect the interests of future generations by checking erosion and wasteful loss of soil fertility.

It was recognized that in order to develop the program in this direction, it would be necessary to obtain better coordination of the procedures employed for the various commodities, to place less emphasis on the temporarily useful historical base for determining adjustments, and to provide for greater flexibility in adapting the program to local conditions and problems.

In other words, the Agricultural Adjustment Administration was seeking some permanent agricultural program which would benefit both farmers and the public at large. Basically, such a program would rest upon continued development and improvement of research and economic information along lines comparable to those followed in the previous outlook work. Effective cooperation of farmers and public agencies in disseminating this material and preparing local or regional plans would be facilitated through the extensive system of local and county committees set up to administer the commodity-adjustment programs. Plans so prepared would be coordinated on a national basis by the central office of the Agricultural Adjustment Administration. Finally, the procedures developed for regulating production would be used in carrying out these plans.

In the preparation of plans for 1936, much work was done toward changing the program in this direction. Before the plans could actually be put into operation, however, they were abruptly checked by the Supreme Court's invalidation of the general production-control procedure.

IV. THE SIGNIFICANCE OF THE SOIL-CONSERVATION APPROACH

Continuation of the program was assured by the passage of the Soil Conservation and Domestic Allotment Act. The provisions of this legislation and of the plan through which it has been carried out were influenced by what had already been done toward a gradual transition from the emergency undertaking to a long-time program and by immediate considerations arising out of the circumstances at the time.

The procedure adopted was that of promoting general shifts in the use of land from intensive to extensive uses and of encouraging improved farming practices. Emphasis was placed on the immediate value of these adjustments in checking erosion and reducing the rate of depletion of soil fertility. This approach involved restraint upon production of surplus cash crops to the extent necessary for soil conservation, and stressed diversion from soil-depleting to soil-conserving crops as protection against loss of soil fertility.

By providing cash benefits for farmers who diverted land from soil-depleting uses, the program had the incidental but important by-product of encouraging a measure of readjustment in production, principally in the direction of less intensive systems of farming. Such a readjustment involved some reduction in the output of the principal soil-depleting commodities, at least for a time. But to the extent that it brought about improvements in systems of farming, and a more economical use of agricultural resources, it might provide a larger supply of farm produce after the adjustments were established.

This shift to a more general type of adjustment avoided problems which had arisen from the overlapping of the previous commodity plans, and allowed a more effective adaptation to regional and local conditions. Although it still employed the historical base for determining adjustments, the plan could be made much more flexible than before. Moreover, an authorization for payments totaling $500,000,000 per year contained in the Soil Conservation and Domestic Allotment Act provided nearly the same amount of direct income enhancement for farmers as had resulted from the benefit payments under the Agricultural Adjustment Act of 1933.

All of these changes were in line with the ideas which had been developed regarding the requirements of a satisfactory permanent program. From the standpoint of adjustment procedure, therefore, the soil-conservation program was entirely consistent with long-time objectives. It amounted to a change from a negative to a positive approach to agricultural conservation by encouraging what may be briefly described as "good farming."

The immediate objectives of the conservation procedure, however, were influenced by the circumstances under which it was introduced. Once more these circumstances were those of an emergency, this time an emergency brought about by the abrupt termination of production control. When the new plan was authorized there was very little time to work out the manner in which it was to be applied in 1936. Of necessity, therefore, its detailed provisions were worked out in haste, with little opportunity to develop the full potentialities of the plan.

In this emergency, one important consideration was to protect the income gains already made and to guard against reversion to the situation that existed in 1933. Hence, the benefit payments were looked upon as a means of maintaining farm purchasing power at the higher level that had been attained, and the terms of the plan were influenced somewhat by the necessity of making it possible for all farmers to participate so that this supplemental income might be widely distributed. Moreover, the conditions of payments were determined in part by the insistence of farmers, particularly those outside the drought areas, that the program should maintain sufficient rein upon acreage and production to prevent the reappearance of large supplies, the accumulation of surplus stocks, and the collapse of prices. Both of these influences tended to distract attention from the conservation basis of the plan, and so tended to limit its effectiveness in encouraging the desired long-time adjustments.

The operation of the program was upset in 1936 by another drought even worse than that experienced only 2 years before. Consequently, the program was not significantly modified in 1937, the principal changes being minor and designed chiefly to increase effectiveness in restricting the acreage of particular crops or to provide a better distribution of the cash benefits.

In view of all these considerations, the principal immediate effects of the program in 1936 and 1937 are most accurately stated as: First, the continued disbursement of income benefits in order to maintain the progress already made in reestablishing farmers' incomes at more satisfactory levels; second, the prevention, insofar as possible, of the reaccumulation of excessive supplies and the collapse of prices by

continuing a measure of restriction upon soil-depleting acreage; and finally, a wider adoption of better farming practices in order to check erosion and conserve soil fertility by promoting diversion of land from soil-depleting to soil-conserving uses.

V. NEW LEGISLATION FURTHER CLARIFIES OBJECTIVES

With the removal of direct restriction upon production of specific commodities, acreages of some principal crops expanded significantly in 1937. In large part these expansions resulted from short supplies and high prices brought about by the extreme drought of 1936 after carry-overs had been materially reduced by the adverse conditions in 1934. In the case of other crops, particularly cotton, corn, and potatoes, unusually high yields per acre caused a significant expansion in total supplies even though there was no increase in acreage. The effect in either case, in view of the acreages apparently impending for 1938, was to bring the problem of surpluses again to the fore.

This situation, together with the trends in thought which had developed out of nearly 5 years of experience with the adjustment program, and particularly out of 2 years of experience with severe drought, definitely influenced the character of the new legislation enacted in 1938. Out of the drought experience, in particular, came renewed emphasis upon the adoption of some form of the Ever-Normal-Granary idea as the basis for evening out total annual supplies of major farm commodities. The specific provisions of this legislation have been outlined earlier in this report. They are considered here only for the light they shed upon the further evolution of continuing objectives.

First, and most obvious, is the emphasis which the Agricultural Adjustment Act of 1938 places upon the control of total supplies. The new act in this respect differs significantly from the Agricultural Adjustment Act of 1933. The original act sought control of acreage or production of certain crops; the new act seeks control not of production, or acreage, but of the marketing of surplus supplies, so that the over-plenty of bountiful years may be conserved for years when it may be needed. In order to effect such control of surpluses, the act authorized the establishment of marketing quotas and imposes penalties upon marketings in excess thereof.

The second point of importance, and one which arises naturally out of the first, is that the 1938 legislation gives specific attention to fluctuating yields and prices as causes of economic instability, and definitely establishes the stabilization of annual supplies and prices as one of the objectives of the program. Actually, this objective has been evolving over a considerable period. In the problem of long-time adjustment a most important consideration is that of establishing cropping systems which will promote stability in farming by minimizing fluctuations in acreage and production. A most telling argument in favor of the soil-conservation plan has been that, in encouraging shifts to less intensive crops which are least affected by drought and other yield hazards, it has been moving in the direction of this kind of stability. In other words, in emphasizing by its control

of surplus supplies an Ever-Normal Granary in cribs and granaries, the 1938 act does not remove its emphasis upon maintaining a permanent Ever-Normal Granary in the soil.

A third aspect of the new legislation which helps to clarify objectives is the act's explicit authorization of cash payments for the direct purpose of supplementing farmers' incomes. This has already been described as an important function of virtually all benefit payments. In most cases, however, payments have been conditioned upon performance by farmers and therefore have served also as the means by which adjustment was secured. But as early as 1935 a special class of benefits known as "price-adjustment payments" was paid to cotton growers who participated in the program. These payments were made, not as an inducement to adjust production, but for the specific purpose of increasing incomes. The "parity payment" provision of the 1938 act now authorizes an identical type of payment for corn, wheat, tobacco, and rice, as well as for cotton. To this extent, therefore, the new legislation explicitly recognizes the disbursement of cash income supplements as a purpose of the program.

The fourth feature of the 1938 act which reflects evolution of objectives is the placing of the problem of long-time adjustment in a somewhat different position in the program. In some respects this problem has been made secondary to more immediate and pressing needs. In part this shift results automatically from the renewed emphasis upon controlling surpluses and raising incomes. But to an even greater degree it is brought about by the kind of procedure established, in particular by its comparatively rigid character.

To be effective in dealing with the problem of long-time adjustment, the procedure used should preferably be flexible and adaptable in its application to regional, local, and individual farm conditions. Primarily because it has this adaptability, and because it provides a positive approach to the problem of improving systems of farming, the soil-conservation plan probably has a greater potential effectiveness for obtaining these long-time adjustments than did the original commodity-adjustment plans. In all the earlier plans, the procedures to be followed were not rigidly defined by law. Administratively they could be modified in their application under special conditions. Hence, they were relatively more flexible than the formulas contained in the Agricultural Adjustment Act of 1938. For this reason, further evolution toward flexible long-time planning is in some respects dependent upon continued attention to this matter by Congress.

However, certain other aspects of the present legislation are consistent with further development of a long-time program. For example, the importance of according farmers and their representatives a large place in formulating and administering long-time plans has been continuously emphasized. Through the definite provisions for farmer committees and the placing of specific responsibilities upon them, this importance is now recognized for the first time in the legislation upon which the program is based. Moreover, in its attempt to find a suitable substitute for the historical base, and in its specific instruction that trends be taken into account in the distribution of recommended allotments, the new act contemplates further immediate development of a fundamental nature.

All in all, the legislation now permits, and to a degree requires, changes which should make the program more effective for promoting desirable long-time internal adjustments in farming. In addition, it provides two principal lines of approach to a better marketing adjustment. The first of these is crop insurance, which is made available to wheat growers in 1939. The other is the systematic accumulation of supplies in an Ever-Normal-Granary reserve of corn and wheat to be carried over as a protection against future shortage. This systematic storage is to be accomplished through an elaboration of the commodity-loan plan and its integration with other features of the program, particularly crop insurance and marketing quotas.

VI. OBJECTIVES IN MARKETING AND DIVERSION ACTIVITIES

Up to this point the interpretation of objectives has dealt only with adjustment or, under the new act, with control of supplies marketed. These features have constituted the central features of the program, and, until fairly recently, have been viewed as the principal expression of the adjustment policy. Nevertheless, marketing agreements, licenses, Secretary's orders, and a variety of diversion operations have played important parts in the over-all program.

The evolution of these activities in marketing adjustment has been in marked contrast to that of production adjustment and soil conservation. Certainly it proceeded from a different starting point in 1933. In the original adjustment act, provisions for this line of effort were very brief and sketchy. They provided merely the authority to use marketing agreements and licenses for carrying out the policy of the act and made funds available for expansion of markets and removal of surplus farm products.

The origins of these provisions are traceable to earlier farm relief proposals which contemplated very different procedures. Hence, at the outset of the program there was considerable difference in opinion as to how these provisions should be employed and as to where the emphasis should be placed as between production activities and marketing activities.

Insofar as the various elements of that program were recognized during the earlier phases of operation, marketing adjustment did not have nearly as large a place in the long-time program for agriculture as did the commodity plans. If those leaders who viewed the emergency adjustment efforts of 1933 and 1934 as positive steps toward a permanent program had been directly asked, they probably would have agreed upon the importance of giving marketing a prominent place in any such program; but it is equally probable that up to that time they were thinking largely in terms of production adjustment. Hence, there was no unified view as to the lines along which marketing efforts should be developed.

Under these circumstances marketing and diversion activities, even though playing a steadily larger part, have not played as important a role in the program as the commodity plans. At first there was a tendency to handle each problem as it arose, and highly diversified procedures resulted; but, with the authorization of additional methods and the development of better means of coordination, the scope

of the marketing operations has been extended until they now represent a very significant segment of the Agricultural Adjustment Administration program.

The broad aims of the marketing procedures have been similar to those of the adjustment plans. They have sought to adjust supplies in line with the Ever-Normal-Granary idea by control or diversion of otherwise unmarketable surpluses. They differ from the more general adjustment procedure in that they are more frequently directed toward the solution of special problems of a local or seasonal character, and consequently reveal a greater diversity in immediate objectives and methods of operation.

It is sufficient for the purposes of this chapter to note that each marketing program has been definitely designed to benefit farmers. Hence, the principal immediate objective has been similar to those of production adjustment, soil conservation, and other methods of surplus control.

VII. CONTINUING OBJECTIVES OF THE PROGRAM

In tracing out the purposes of the program in its various stages of development, the preceding sections have revealed how these purposes have been influenced by the circumstances of the times. Since conditions have changed with great abruptness at times, this account tends to emphasize the instability of the immediate objectives. But it also shows clearly how these immediate purposes have been continually linked together in the gradual evolution of underlying ideas which provide a solid framework for the program. These ideas have been subordinated at times almost to the point of being obscured; nevertheless, as the program has continued they have repeatedly emerged as persistent tendencies running through the whole undertaking. These tendencies are significant expressions of continuing objectives in agriculture.

Not all the features of the program through which these objectives are to be attained have been developed or fully revealed as yet, but the objectives themselves are sufficiently clear to be stated. They may be summarized under three principal heads.

INCOME ADJUSTMENTS

As has been noted, enhancement of farmers' income has been a principal immediate objective of the program from the outset. Moreover, all evidence shows that this aim will be continued. Emphasis upon it has increased rather than decreased, and it is by far the most prominent objective in the minds of many who accept the programs as part of national agricultural policy. Therefore, it must be accepted as one of the primary continuing objectives.

It should be remembered, however, that income adjustment includes more than adjustment as between farmers and other groups. There is also a definite tendency to help those within the farm group who are in greatest need of help. Consequently, as the program has developed there has been an increasing tendency, both in the legislation and in its administration, to provide for graduated payments which would favor small producers and would limit payments

to large operators. Measures for the specific relief of drought-stricken areas, and those for the protection of the interests of tenants, are evidence of similar tendencies. Some of these measures have not been carried far, but enough has been done to show the desire to insure certain minimum income to each participant. Furthering these tendencies in a very important way has been the work of the Farm Security Administration, which since its establishment has worked in close cooperation with the Agricultural Adjustment Administration.

Another aspect of income adjustment is that brought out by the Ever-Normal-Granary plan. The aim in this connection is stabilization, which represents possibly the most important development of objectives under the Agricultural Adjustment Act of 1938. So far the most prominent emphasis on this objective has had to do with smoothing out the more sporadic year-to-year variations in prices, particularly those which result from fluctuating yields. Attention is being directed toward the possibility of doing this by carrying over excessive supplies from one season to another as a reserve against future shortage.

A parallel procedure is directed toward evening out intraseasonal variations in price which result from unavoidable seasonal variations in supplies. This procedure is exemplified by the butter stabilization plan. By buying butter during the flush period of the year when prices are low and making supplies available on a cost-plus basis to the trade during the winter months when supplies are short, the program brings greater stability to butter prices and eliminates the extremely low prices of periods of peak production when buyers move large quantities into storage. For the consumer, this procedure assures a plentiful supply of reasonably priced butter at all times by providing for the release of supplies when stocks are low and extremely high prices are imminent.

Another newly developed stabilizing effort is that provided by crop insurance. A broad plan for insuring crop yields should mitigate the effects of crop failure upon the incomes of individual farmers, and contribute effectively to the Ever-Normal-Granary objective.

Still another approach to the problem of achieving greater agricultural stability is that of promoting permanent adjustments toward systems of farming which are best adapted to particular local conditions and which minimize the effects of varying weather and other yield hazards.

SOIL CONSERVATION AND EFFICIENT FARMING

Less easily discernible than income adjustment in current activities, but of equal importance as continuing objectives, are those relating to long-time internal adjustments in farming. Although never actually in the ascendancy, these have been continually present, and at times have been most influential in determining the lines along which the program has developed.

The character of these objectives should be clear from a review of their evolution. In general they relate to the promotion within agriculture of permanent adjustments which will enable the industry to make its greatest possible contribution to the national well-being

by furnishing the most economical supplies of farm products that can be produced with existing resources.

Most economical does not mean largest or cheapest supply that could be produced within any 1 year. Such a supply would not be truly economical because it would be far in excess of what was needed and could be produced only by using labor and other resources which might be used far more advantageously otherwise. Moreover, it would require the wasteful exploitation of resources which would be of more value to society if reserved for some future time. Economical supply, as the term is used here, means a supply produced by the most efficient methods and through the use of land and other resources best adapted to its production. It also means a supply balanced with supplies of goods other than farm products, so that those who produce the supply receive a return equal to what they could earn in any other industry. Finally, to be economical, a supply must represent a proper balance between present and future needs. It is not economical if produced with resources which should properly be conserved for the future.

The specific objective of conserving soil resources which has been emphasized during the past 2 years relates to one aspect of this problem. Efficiency in farm operations, adequate supplies for consumers, the planned use of land, and similar terms are often used to distinguish other specific goals. But from whatever angle these goals are approached, it is clear that they all relate to particular aspects of this general problem of long-time adjustment.

DEMOCRATIC PLANNING AND OPERATION

The movement towards agricultural planning has been going on for many years. Up to 1933 it had developed farthest in the educational programs of the Department of Agriculture and allied agencies, particularly in connection with the annual outlook work. In the agricultural adjustment and soil-conservation programs, planning had advanced to what may be called the action stage. Previously, the plans that were formulated could be carried out only by individuals assisted by education and advisory guidance. With the approval of the first adjustment legislation, planning was inaugurated on a much broader scale.

Under the provisions of the successive legislative enactments, the Secretary of Agriculture, and through him the Agricultural Adjustment Administration, has been given a mandate to undertake immediate action. The methods which can be employed and the limits within which they can be applied have been prescribed by Congress. But particularly in the early years of operation, this authorization has been so broad as to leave a wide latitude for administrative decision, both in formulating plans and in determining how they should be carried out.

To this extent the Agricultural Adjustment Administration has been established as a central agency to undertake planning on an action basis. Administratively, the immediate objective necessarily has been to develop a program which would carry out effectively and efficiently the policy established by Congress.

It has been the belief of the Administration that planning can not be carried out effectively and economically unless the farmers themselves understand the whole idea involved. Moreover, the methods employed must be practical according to farmers' own standards, and these standards can hardly be met unless farmers share much of the responsibility for determining what the program is going to be. This means getting the whole body of farmers to think and act for themselves, and implies a unity of attitude that can result only from an understanding of the facts involved.

From this point of view it is not sufficient that the legislation itself be democratically enacted. The actual formulation and administration of the programs must also be carried out in a democratic manner, with the farmers themselves actually taking part in the process of planning and policy making. Hence, the Agricultural Adjustment Administration has attempted to use the latitude given it by the legislation as a means of sharing its responsibility with the farmers themselves. In this way it has sought to promote cooperative relationships through which constructive economic plans for agriculture may be developed through methods in complete harmony with the principles of democracy.

Even in the emergency period, when decisions had to be made promptly in order to carry out the specific intent of the law that action be taken at once, these decisions were made insofar as possible in consultation with representative farmers. In succeeding periods continuous attention has been given to developing methods for securing the most effective participation of farmers in the administrative process.

At first this sharing of responsibility with farmers and their representatives was possible because of the wide administrative latitude given the Secretary of Agriculture, rather than because it was directly authorized by the adjustment legislation. But just as recent enactments have tended to reduce this latitude by specifying in more detail the procedures to be applied, so there has been a parallel tendency to incorporate provisions for specific forms of farmer representation and for assignment of definite administrative responsibilities to these representatives. As a result, the underlying idea of developing farm programs on a permanently democratic plane is now fully apparent in the legislation on which these programs must be based.

CHAPTER 5

EFFECTS OF THE ADJUSTMENT PROGRAM ON PRICES AND INCOME

During the past 10 or 12 months, the Agricultural Adjustment Administration, in making preparations for this report, carried out economic studies along several lines. Among them, and paralleling an attempt to measure the effects of conservation on soil fertility, was a statistical analysis of the effects of the adjustment programs on farm income. Economists of the Agricultural Adjustment Administration and the Bureau of Agricultural Economics worked together in making the study. Tentative estimates are presented in this chapter of the effects of the adjustment and conservation programs on the income of producers of certain major commodities: Wheat, corn, livestock (hogs, cattle, and sheep), and several kinds of tobacco.

Despite certain limitations inherent in this approach, it is believed that it will prove of real value in pointing the way to studies of the comparative value of alternative farm programs. This is important because all indications point to a continuing need for a national farm program, and administrative leaders and Members of Congress in the future may be a great deal more interested in measuring comparatively the advantages of different farm plans than in measuring absolutely the income benefits of any one plan.

I. ASSUMPTIONS UNDERLYING THE EVALUATIONS

An interesting and instructive aspect of these statistical studies of the income effects of the A. A. A. programs is found in the assumptions that had to be made before the statistical method could be applied. Because precise measurements of the income effects of the farm programs were desired, these assumptions had to be worked out and their exact nature revealed. When the assumptions are listed and examined they shed as much light as the figures themselves on the work of the programs that have been carried out by the farmers through the A. A. A.

The attempt to measure the effect of a farm commodity program upon the income of the producers of that commodity is really an effort to estimate in dollars and cents the difference between the income that they got with the program and the income that they would have got without a program.

So the nature of the first broad assumption to be made before working out the estimates becomes readily apparent. It is that other conditions would have been the same with or without a program for the commodity in question. Numerous further assumptions have to be made but this first one is basic.

Its significance is emphasized by the second assumption which follows immediately from it. This is the assumption that recovery from the depression would have occurred whether or not there had been a farm program for the farm commodity concerned.

The adjustment operation for each of the farm commodities was in fact just one part of the vast business, employment, and agricultural recovery program launched by the Federal Government. With this broad program the Government did what it believed had to be done to prevent the collapse of the Nation's economic system. The adjustment plan for the one farm commodity being studied probably never would have been used except as a part of the general recovery program, and the launching of the general recovery program once determined upon made it practically sure that the producers of each one of the great basic farm commodities would be offered an adjustment plan. The adjustment plan for the commodity and the general recovery program, therefore, were probably inseparable, in actuality.

Whether there would have been economic recovery without any national recovery program or whether the economic system would have gone further and further into collapse is a question which a study limited to one farm commodity or a group of farm commodities does not attempt to answer. And, although it may be true that without a general economic recovery program, a separate program for the individual farm commodity in question would have been highly unlikely, this probability also is left out of account.

In other words, in making these studies, the economists have not tried to answer either way the questions about these probabilities. They have simply made their studies in the light of the fact that recovery did occur, and of the fact that the program for the farm commodity studied did exist. Corollaries to the assumption that general economic recovery would have taken place precisely as it did are the further assumptions that farm programs would have existed for all basic commodities except the one for which estimates of income without any program are made, and that therefore there would have been a general rise in farm income and in the power of producers of other farm commodities to buy the one farm commodity being studied.

The rise of consumer income which accompanied the recovery program, and which in itself was sufficient to lift the income of many farm commodities, especially livestock products, is also assumed.

The painstaking work of economists in attempting to work out close estimates of the income effects of plans for some farm commodities brings out more than just the figures. Six years after the launching of the Government's recovery program, the far-reaching effects of that program have to be assumed as a starting point for a study of the results of any one part of that program. And the other assumptions that have to be made show the close relationships between the income problems of city and country and of producers of different farm commodities.

The estimates of the effects of the farm plans on the income of the producers of the several commodities listed are of course very much smaller than they would be if the basic assumptions had been contrary to those actually made. It is perhaps surprising that, starting on the basis of such assumption, the results shown should

be as large as they are. The methods employed apply the severest and most meticulous statistical test, and still the value of the farm program in terms of farm income is shown.

II. CONDITIONS AND LIMITATIONS OF THE ANALYSES

Under the original commodity adjustment programs, income enhancement was sought in large part through efforts to adjust acreage, production, and market supplies, and to raise prices. The distressed condition of agriculture generally was held to be due in large part to the accumulation of burdensome surpluses, the pressure of which was keeping the prices of farm products and the income of farmers at levels which not only were ruinous to agriculture but also constituted a serious barrier to general economic recovery. Since the demand for many important farm products is relatively inelastic, the most effective way of restoring agricultural purchasing power was so to adjust production as to bring supplies to a level corresponding to the requirements of normal domestic consumption and probable export demand. But inasmuch as the competitive situation in agriculture was not such as to enable individual producers without concerted action to make rapid downward adjustments on a large scale, an acreage control program involving the simultaneous cooperation of a large majority of the producers of basic commodities was put into effect in 1933. This approach continued in operation until January 1936, when the act under which the programs were formulated was declared unconstitutional.

With the invalidation of the original Agricultural Adjustment Act and the substitution therefore of the Soil Conservation and Domestic Allotment Act, conservation became the primary objective of the program. Such income effects as resulted from this program came about in either of two ways: By payments made to producers for shifting the use of land from soil-depleting to soil-conserving crops or practices, or by price enhancement resulting from such incidental adjustments of the basic crops as were effected by the conservation program.

STUDY LIMITED TO 4 MAJOR COMMODITIES

This chapter presents in summary form the results of preliminary analyses of the effects on prices and gross incomes of those phases of the program which involve: (1) Adjustments in wheat, cotton, corn, hogs, and tobacco, 1933–36, and under the conservation programs in 1936 and 1937; (2) purchase and loan and subsidy programs applying to these commodities, and to cattle and sheep; and (3) payments made to producers cooperating in specified programs, from funds partly collected through processing taxes or advanced as grants-in-aid out of direct appropriations under the conservation program. A general evaluation of the experience with commodity purchases; surplus diversion; and marketing agreements, licenses, and orders, for dairy and poultry products and general crops is undertaken in chapter 7.

An appraisal of the price and income effects of all commodity programs and of the agricultural program as a whole is essentially a long-time research project transcending the scope of this chapter.

The findings with respect to the four major commodity programs which are summarized below can only be considered as a first step.

In making the estimates pertaining to each of these commodities, it was necessary (*a*) to determine the production, carryover, total supplies, domestic demand, foreign demand, prices, and incomes for the commodity which probably would have prevailed in the absence of the benefit payments and program for that commodity, and (*b*) to compute the difference between these estimates and the corresponding actual figures for the period in order to arrive at an estimate of the effects of the program on the commodity. Since the best procedure to follow depends partly upon the characteristics of the commodity, and partly upon other considerations, no attempt has been made to attain complete uniformity of treatment for the several commodities.

In every case, however, an attempt has been made to isolate those changes in prices and income attributable to the adjustment program as such. This, obviously, can not be done in an unequivocal way, as other important factors affecting prices and income were operating concurrently with the program, and existing statistical technique is not adequate to the task of measuring the influence of the several factors with precision.

WEATHER AN OBSCURING FACTOR

One of the important obscuring factors was the unusual weather conditions which prevailed during part of the period covered. Had these not been present, the effects of the adjustment programs would have been materially different from what they were. Instead of rising rapidly to levels so high that declines were inevitable as soon as the effects of drought wore off, prices would have gone up more gradually to more moderate and stable levels. Actually, unfavorable weather did to production, to an extreme degree, what the programs had been intended to do more moderately. No attempt has been made to evaluate the probable accomplishments of the presence of the normal conditions they were designed to meet, with weather conditions different from those actually encountered, since this would have introduced too large a measure of conjecture into the assumptions upon which the analyses rest. Another big factor which eludes precise measurement is, of course, as already emphasized, the Government recovery program, including the monetary and industrial policies which influenced price levels and business activity and had their repercussions in the agricultural sphere.

INDIRECT GAINS NOT CONSIDERED

It should be noted also that the use of estimates of gross income does not furnish a fully accurate indication of the extent to which the program may have affected the well-being of farmers. Since net incomes are more important than gross, the analysis would have to indicate the effects of the programs upon production costs. But the benefits accruing from reduced costs are even more difficult to appraise than those from price enhancement. Reliable estimates can not now be made. However, logical considerations, supported by such evidence as is readily obtainable, indicate that insofar as the program curtailed production it effected savings in immediate cash

expenses. But these savings probably were not in proportion to the reduction in acreage.

In addition to the direct income benefits which farmers received from the program, certain indirect benefits arose from the conservation of their soil resources as a result of the several programs, and from improvement in general economic conditions, which in turn received a positive stimulus from the anti-deflationary influence of the adjustment program itself.

To the extent that farmers reduced their acreage of soil-depleting crops, especially corn, wheat, and cotton, and to the extent that they were encouraged to shift this acreage to soil-conserving crops or to uses which caused a smaller drain on their soil resources, the values of their farms were enhanced. No exact measure of the gain attributable to this factor can be obtained, but it is certain that farmers who cooperated in the conservation programs in 1936 and 1937 obtained a real benefit in this connection.

Nor can the magnitude of the gains due to the effect of the programs upon the general business situation be reliably estimated in a study with so limited a scope as this one. It should be noted, however, that one result of choosing this basis for analysis of the effect of the several programs is practically to assume a general economic recovery, whereas no such recovery might have occurred at all except for the general program of which the farm program was an important part. Once such recovery is assumed, however, one effect of the assumption is to make income benefits from the farm program appear to grow smaller as the depression gets further into the past.

Finally, a complete evaluation of the program would take into account both the effect of the adjustment of supplies upon wage-earners and businessmen, and the effect of higher prices upon the cost of goods to consumers. Neither of these effects is adequately dealt with in the present discussion, which is directed primarily toward the problem of estimating the effects upon farm prices and gross income to farmers.

In view of the foregoing considerations, the estimates which follow, although stated in terms of pounds and bushels, and dollars and cents, are to be regarded not as precise measurements but as general and tentative approximations.

III. CORN AND LIVESTOCK

The diverse group of activities relating to corn and livestock have included production adjustment for corn and hogs; Government purchases of cattle, hogs, and sheep; corn loans; and acreage adjustments for major feed crops.

During the period from 1933 through 1936 it appears that the various A. A. A. programs resulted in a substantial increase in the cash income of livestock producers as a group. The results of this analysis indicate that during the 4 years the cash income from hogs, cattle, sheep, and lambs was about 784 million dollars, or 14 percent, greater than it would have been in the absence of the A. A. A. programs. It is estimated that the A. A. A. programs resulted in a net increase in the cash farm income from corn, after deducting sales

to farmers, of about 27 million dollars. This analysis, however, provides no basis for indicating what the results of the programs would have been if the level of national income had not been lifted by the recovery from the depression. Since farm income from the marketing of livestock tends to rise in direct ratio to the rise of consumers' buying power, the national recovery was an exceedingly important factor in the improvement of farm income from sale of livestock. If there had been neither a national recovery program nor any part of that program for the corn and livestock growers, their income might have been far lower than it was, but this study does not make allowance for that factor. Neither does it provide a basis for indicating what the results of the programs would have been if the severe droughts of 1934 and 1936 had not occurred.

The following table shows the reported cash farm income from meat animals, including Government payments, and the estimates of what the income would have been without the A. A. A. programs for the years 1933–36. It will be noted from this table that the gain in income resulting from the programs was greater for hogs than for cattle. There was some increase in income from hogs in each of the 4 years, but most of the increase in the income from cattle and calves was in 1934, when the bulk of the purchases of cattle by the Federal Government for drought relief was made. In 1934, the increase in income from cattle resulting from the A. A. A. programs was the greatest for any one species of livestock in a single year. The large increase in income of livestock farmers in 1934 resulting from the A. A. A. programs was especially timely, in view of the severe drought over wide areas in that year.

TABLE 15.—*Estimated cash farm income from meat animals with and without the A. A. A. programs, 1933–36*

[Figures in millions of dollars, i. e., 000,000 omitted]

Year	Estimated income[1] from meat animals reported	Estimated income without A. A. A. programs	Gain in income resulting from programs			
			Hogs	Cattle	Sheep and lambs	Total
1933	1,057	991	66			66
1934	1,472	985	182	298	7	487
1935	1,922	1,787	121	14		135
1936	2,098	2,002	96			96
Total	6,549	5,765	465	312	7	784

[1] Includes benefit payments and payments for purchases of cattle, hogs, and sheep.

CORN AND HOGS

Three factors associated with the A. A. A. programs contributed to the enhancement of the cash income of corn and hog producers for the years 1933–37. These were (1) benefit payments, (2) gains resulting from changes in hog supplies, and (3) gains from sale of corn for industrial uses.

The changes in supplies were brought about partly by surplus purchases of hogs and hog products and partly by the production adjustment programs for corn and hogs. On the average, it is esti-

mated that the production adjustment programs were responsible for about half of such changes. The relative effects upon hog supplies of surplus purchases and production adjustment in each of the 4 years (1933–36), however, were much different from those for the entire period.

Briefly summarized the estimated changes in total cash income of corn and hog producers which resulted from the various parts of the A. A. A. programs for the years 1933 through 1936 appear to be about as shown in table 16.

TABLE 16.—*Estimated changes in total cash income of corn and hog producers resulting from A. A. A. programs, 1933–36 inclusive*

	Millions
Total benefit payments on corn and hogs (includes payments for purchases of pigs and sows in August and September 1933)	$519
Net tax collections on corn and hogs	260
Net Government payments	259
Estimated amount of hog processing tax absorbed by farmers	239
Total collections less absorption by farmers	21
Gain to farmers because of changes in hog supplies caused by A. A. A.	185
Gain to farmers in cash income from sale of corn for industrial uses resulting from A. A. A. loans, production control, etc	27
Net Government payments	259
Total gain	492

The figures in the foregoing table should not be considered unequivocal as they are based upon quantitative analyses of hog prices and incomes which are not as precise as one might wish. Thus the figure of $21,000,000 is a balance item. It is that part of the total gain remaining after gains due to particular parts of the programs had been allocated, and it is presumed to represent the amount of total tax collections on both corn and hogs which was not borne by producers.

It may be noted that the estimates shown above check fairly closely with a study of the incidence of processing taxes prepared by the Bureau of Agricultural Economics,[5] in which it was concluded that the processing tax on hogs was borne almost entirely by hog producers, and that little or none of the processing tax on corn was borne by farmers. Since the net tax collections on corn were $12,000,000 this amount may be deducted from the $21,000,000 balance item, leaving only $9,000,000, or 4 percent of the net hog processing tax collections, as representing hog taxes not absorbed by farmers.

No attempt has been made to estimate the effect of the conservation programs in 1936 and 1937 upon corn and hog production and income therefrom. Neither the corn nor hog programs were continued after the Supreme Court decision invalidating the acreage control and processing tax features of the Agricultural Adjustment Act of 1933. Instead, corn was included along with such other soil-depleting crops as wheat, oats, and barley in a general soil-depleting base in 1936.

[5] "An Analysis of the Effects of the Processing Taxes Levied Under the Agricultural Adjustment Act," prepared by the Bureau of Agricultural Economics and published by the Bureau of Internal Revenue, 1937.

In 1937, corn was again included in the soil-depleting base, although a corn acreage limit was established within this base in order to keep too large a portion of the acreage from being devoted to corn. Altogether, it is probable that the conservation program operated in both 1936 and 1937 to restrict the acreage of corn somewhat, which in turn affected corn production, and to some extent hog production. It is doubtful, however, if these programs materially affected income received except to the extent that the conservation payments represented a net addition to farm income in the corn and hog-producing areas in both 1936 and 1937.

This segregation of the effects of the various parts of the A. A. A. programs for corn and hogs helps to clarify the influence at work, but it does not lead to the conclusion that the separate parts were necessarily good or bad. The program for corn and hogs was an integrated one, each part depending upon and being determined to a considerable extent by other parts. For example, in order to finance a program for production adjustment it was deemed necessary to levy a processing tax on hogs. In order to levy a processing tax and at the same time not reduce hog prices or farm income from hogs, surplus purchases of hogs and hog products appeared to be necessary. The ultimate goal of the programs was to increase incomes of corn and hog producers. This was accomplished, even though some of the separate elements appeared to offset each other.

EMERGENCY CATTLE AND SHEEP PURCHASE PROGRAMS

As an emergency measure to aid cattle producers during and following the unprecedented drought of 1934, the Agricultural Adjustment Administration from June 1934 to February 1935 purchased 8,280,000 head of cattle and calves in drought stricken areas of 24 States. As a result, the commercial slaughter of cattle and calves was materially smaller in 1934 and slightly smaller in 1935 than it would have been had there been no emergency purchase programs. Prices paid by packers on the other hand were materially higher in 1934 and slightly higher in 1935 than they would have been without the programs.

On the basis of the average relationship of cash farm income to packer payments, it is estimated that without the program cash farm income in 1934 would have amounted to only $400,000,000 as compared with the $592,000,000, exclusive of Government payments, actually received. For 1935, it is estimated that cash farm income would have been slightly lower than it actually was, i. e., about $885,000,000 instead of the $893,000,000 actually received.

In addition to this total net gain of $200,000,000 attributable to supply adjustments, there was an additional gain of $112,000,000 paid by the Government for cattle purchased and as benefit payments. This sum was distributed to producers roughly in proportion to the severity of the effect of the drought on livestock. The remainder, in the form of increased cattle prices, accrued to cattle producers generally.

No shortage of beef resulted from the Government purchase program. Commercial supplies from 1934 to 1936 were considerably larger than average. The apparent consumption of beef and veal

produced under Federal inspection, excluding beef and veal distributed to relief clients, totaled about 5,600,000,000 pounds in 1934, 5,300,000,000 pounds in 1935, and 6,000,000,000 pounds in 1936, compared with a 10-year (1924–33) average of 5,100,000,000 pounds, dressed weight.

From mid-August through December 1934, the Agricultural Adjustment Administration purchased as an emergency drought relief measure about 3,610,000 sheep in 20 States west of the Mississippi River.

To what extent commercial sheep slaughter would have been increased in 1934 if no sheep had been purchased by the Government can hardly be estimated. Because of low prices prevailing in 1934, it is doubtful that the increase in sheep slaughter in 1934, if there had been no purchases, would have been as large as the 1,350,000 head slaughtered under Federal inspection for Government account. It is possible, however, that if there had been no purchases of sheep, marketings of lambs from the western States would have been larger than they were. This might have occurred because the short supplies of feed would have made necessary some reduction in the total number of sheep and lambs in some areas.

If there had been no Government purchases of sheep in 1934, with marketings of both sheep and lambs larger than they were, prices paid for both sheep and lambs would have been lower than prices actually paid in 1934. Whether the total amount paid for sheep and lambs in 1934 would have been larger or smaller than the total amount actually paid for commercial supplies in 1934 can hardly be determined. Assuming that the increase in marketings would have been offset by the lower prices, the total amount received by producers from the sale of sheep and lambs would have been about the same as the amount received in 1934 for sheep and lambs sold commercially. Hence, it may be concluded that the gain in the income of the sheep and lamb producers resulting from relief purchases in 1934 was about equal to the $7,000,000 expended for sheep purchased by the Federal Government.

IV. WHEAT

The Agricultural Adjustment Act of 1933, as subsequently amended and supplemented by other acts, made provisions for the following activities with regard to wheat: (1) Acreage adjustments with payments to producers, (2) removal of surpluses, (3) processing taxes, and (4) commodity purchases. The programs were carried out under very abnormal conditions and only a part of the data available lends itself to quantitative treatment. As a result, the estimates given in this section should be considered only as approximations, rather than as accurate measurements. The significance of this analysis for appraising acreage-adjustment programs is severely limited because drought in 1934 and 1936 and rust conditions in 1935 forced drastic changes in the provisions of the program, which tended to nullify the results which the original program might have obtained.

Table 17 summarizes the estimated effects of the programs on income to wheat growers.

TABLE 17.—*Estimated cash income to wheat growers with and without programs, 1933–37*

[Dollars in thousands, i. e., 000 omitted]

Year	With programs	Without programs	Total gain	Income with program as a percentage of income without program
				Percent
1933–34	$378,116	$273,505	$104,611	138.2
1934–35	403,018	329,146	73,872	122.4
1935–36	471,446	362,852	108,594	129.9
1936–37	[1] 444,053	443,620	433	100.1
1937–38	[1] 650,076	644,457	5,619	100.9
Total	2,346,709	2,053,580	293,129	114.3

[1] Does not include soil conservation payments accruing to wheat growers.

Because of drastic modifications mentioned above, the cash gains attributable to the programs are, for the period as a whole, traceable primarily to the benefit payments made in connection with the production adjustment programs. These payments totaled $315,800,000 for the 3 years, 1933–35. No payments were made for wheat acreage adjustment in 1936–37 and 1937–38, wheat being only one of the several soil-depleting crops.

Partly because of the droughts and partly because of the relaxation of contract requirements in order to alleviate hardships arising out of the droughts, acreage contraction attributable to the programs was small. It is estimated that the programs were responsible for a reduction of about 35,000,000 bushels in 1934, 10,000,000 bushels in 1935, and an increase of 5,000,000 bushels in 1937. The increase in this latter year is due to the fact that under the conservation programs cooperators were permitted to expand wheat acreage provided they curtailed their acreage seeded to other soil-depleting crops. Negative influences upon income have been assigned to the production-adjustment phases of the program in 1934 and 1935 because it appears that increases in income resulting from increased price did not offset the reduction in income resulting from a reduced quantity for market.

In addition to supply changes, the programs exerted some influence upon price by reason of changes in stocks consequent on changes in the disposition of flour, feed, and seed. These changes were caused by such things as the subsidization of exports and shipments in 1934–35 and 1935–36, increases in stocks attributable to reduced flour production following the imposition of processing taxes, which were partially offset by flour purchases on the part of the Federal Surplus Commodities Corporation, the diversion by the Corporation of 8,000,000 bushels of wheat into feed uses in 1934–35, and decreased seedings in the fall of 1933 and the spring of 1934 attributable to the adjustment program. On the whole, however, the net influences on price, though largely positive, were small.

V. COTTON

The measures which have been employed by the Agricultural Adjustment Administration with respect to cotton have included acreage

adjustment, marketing quotas, benefit and price adjustment payments, Government loans, and processing taxes. The problems involved in estimating the effects of these operations are exceedingly difficult. Not only do they include those common to price and income analyses in general, but with respect to cotton they are especially complicated by the fact that considerations relating to competitive foreign supply and demand are of greater importance than in the case of any other commodity considered in this chapter.

Many factors other than the program of the Agricultural Adjustment Administration have influenced the course of cotton production in foreign countries and the consumption of United States cotton in foreign markets. Difficulties inherent in the complex problems of analyzing these influences preclude the possibility of absolute proof. Much depends upon the judgment of the individual investigator as to what methods shall be employed or what interpretations shall be made, and hence there is a very considerable range in the estimates yielded by different analyses.

The particular study upon which this discussion is based assumes that the results of the program have been materially affected by the tendency of foreign producers to increase their acreage in response to significant increases in the price of cotton. It can be argued on somewhat different bases that this effect has been greater than is shown by the estimates used here. On the other hand it also can be argued that the actual influence on foreign production has been much smaller, and some studies have been made within the Agricultural Adjustment Administration which indicate that it may have been quite small.

THE METHOD OF APPRAISAL USED

The procedure followed in this study is that of first estimating what the supply, including both production and carry-over, would have been in 1933–34 if no program had been undertaken, and then using these estimates as the basis for computing the prices and incomes which cotton producers probably would have received under these circumstances.

These estimates of supply are used as the basis for estimates of the prices of cotton and cottonseed,[6] which would have been received if no program had been undertaken and from these, together with the estimates of production, a comparable estimate of income is derived. In this calculation it is assumed that all of the lint produced would have been sold in any case, but it is necessary to estimate the probable quantity of cottonseed that would have been sold had the larger crop been produced.

A similar procedure is followed for each of the four succeeding years included in this analysis. For each of these seasons, however, it is necessary to estimate what the carry-over from the preceding season would have been in the absence of a program. This in turn necessitates estimates of probable consumption at the lower prices which would have prevailed. Moreover, the problem of estimating

[6] In the correlation analyses used in estimating cottonseed prices only domestic supply and demand factors were used, although in certain years adjustments were made to allow for changes in foreign supply and demand factors as they seemed to have affected United States prices of cottonseed.

acreage, yield, and production in the United States and foreign countries is considerably more complicated for these seasons than for 1933–34 when most of the acreage had been planted before the program was placed in operation.

In making these estimates separate statistical analyses were used for the United States, India, Egypt, and Brazil.

ESTIMATED EFFECTS OF THE PROGRAM

Estimates of the influence of the programs upon total income from cotton and cottonseed are shown in table 18.

TABLE 18.—*Estimated total income from cotton and cottonseed, including benefit payments, with and without adjustment programs, 1933–34 to 1937–38*

[Dollars in thousands, i. e.. 000 omitted]

Marketing season	Without program	With program	Income with program as a percentage of income without program
			Percent
1933–34	$625,800	$858,179	137.1
1934–35	636,230	850,715	133.7
1935–36	686,103	855,449	124.7
1936–37	913,830	992,062	108.6
1937–38	809,028	990,100	122.4
Total	3,670,991	4,546,505	123.8

These preliminary estimates indicate that under the program the total income received by cotton growers was materially larger in each season than it would have been in the absence of the program. This gain ranged from $232,000,000, or about 37 percent, in 1933–34 to $78,000,000, or roughly 9 percent, in 1936–37. The total gain in income for the entire 5 years was approximately $876,000,000; total income, therefore, was about 24 percent more than the estimate of what it would have been without any feature of the program.

These estimated gains are attributable to the price enhancement accomplished by the restriction of production and by the cotton loans, and to the various types of payments made. For the 5 years combined the actual weighted average farm price of lint was 34 percent higher, the actual average production was 20 percent smaller, and the gross farm income from lint 7 percent larger than the estimates of the average price, production, and income without the programs. In the case of cottonseed, the actual prices were sufficiently higher than the estimated prices in each of the 5 years to result in an actual cash farm income from this product higher each year than the estimated income without the programs, and for the 5 years combined cash farm income averaged 11 percent higher.

Gross cash farm income from cotton and cottonseed for the entire 5-year period (excluding Government payments but including the effects of the higher prices and higher incomes resulting from the loan programs) was approximately $3,900,000,000. This was 7 percent larger than the estimated income, approximately $3,700,000,000, from lint and seed without the programs.

A definitive analysis of the effects of the cotton program would require measurement of the relative effects of loans and production adjustment. For lack of any satisfactory basis for separating these effects, no attempt was made to separate loan and adjustment influences until 1937. In that year the influence of the loan policy was more discernible and an income gain of approximately $142,000,000 has been assigned to that factor.

Table 19 contains annual estimates of income from cotton and cottonseed, excluding benefit payments with and without a program.[7]

TABLE 19.—*Estimated gross cash income from lint and cottonseed, excluding benefit payments, with and without adjustment programs, 1933–34 to 1937–38 (analysis I)*

[Dollars in thousands, i. e., 000 omitted]

Marketing season	Without program	With program	Income with program as a percentage of income without program
			Percent
1933–34	$625,800	$678,525	108.4
1934–35	636,230	734,915	115.5
1935–36	686,103	695,240	101.3
1936–37	913,830	905,682	99.1
1937–38	809,028	918,000	113.5
Total	3,670,991	3,932,362	107.1

ESTIMATED EFFECTS BY A MODIFIED ANALYSIS

In the presentation of the foregoing analysis, it was recognized that the complexity of the factors affecting cotton and the lack of precision in the statistical analyses designed to isolate these factors, require the injection of individual judgment at various points. Valid differences of judgment with respect to the importance of certain factors lead to considerable differences between estimates of the effect of the cotton programs upon income.

Because cotton is a commodity with respect to which there are wide differences of opinion on such matters as the elasticity of the supply-price curve, the relation between price and consumption, and the effects of price upon output, it seems desirable to indicate how certain rather small shifts in assumptions may affect appreciably the estimates of income gains from the cotton programs.

Following is an analysis which departs in two important particulars from the one preceding. The first departure involves the utilization of a somewhat more inelastic supply-price curve taken from another study, and believed to be a reasonably accurate relationship. The second departure involves the assumption that the portion of the increased world consumption of American cotton attributable to the check which American competition might have placed on foreign production in the absence of cotton programs was approximately half as great as appears to be assumed in the first analysis. The assumption, in the absence of a program, of a smaller effect on foreign com-

[7] Attention is called to the fact that comparative incomes with and without the program were more favorable to the program in the first year or two than subsequently. This tendency is in part due to lags in the response of supply factors to the price stimuli of the programs. The statistical analyses involving the effects of foreign cotton supplies were worked out in a way which takes lag influences into account.

petition than appears in the first analysis is introduced because a number of competent analysts believe that the influence of the American cotton program on foreign supplies was not as great as assumed in the first analysis.

Assuming that the income from seed would not have been substantially different from the estimates yielded by the first analysis, combined income from lint and seed would have been as shown in table 20.

TABLE 20.—*Estimated gross cash income from lint and cottonseed, excluding benefit payments, with and without adjustment programs, 1933–34 to 1937–38 (analysis II)*

[Dollars in thousands, i. e., 000 omitted]

Marketing season	Without program	With program	Income with program as a percentage of income without program
			Percent
1933–34	$617,800	$678,525	109.8
1934–35	582,280	734,915	126.2
1935–36	655,162	695,240	106.1
1936–37	865,882	905,682	104.6
1937–38	799,434	918,000	114.8
Total	3,520,558	3,932,362	111.7

Here an average income gain of approximately 12 percent is attributed to the influence of the programs as compared with approximately 7 percent in the first analysis. Including benefit payments, this would represent a gain of 29 percent instead of 24 percent. However, the fact that these two analyses show an appreciable difference in income estimates for the period as a whole should not obscure a basic similarity, namely, that the gains from the program decline over time. Further extension of both analyses would tend to bring their results closer together.

VI. TOBACCO

In an analysis of benefits to tobacco growers resulting from the operation of adjustment and conservation programs, problems must be considered which do not permit of precise answers. Therefore, the estimate of benefits may vary depending upon the relative importance assigned to the several price-making factors, but it is generally agreed that tobacco growers have realized substantial income benefits from the programs of the Agricultural Adjustment Administration throughout its period of operation.

During the commodity adjustment phase of 1933–35, the central element in the program as it applied to the principal types of tobacco was the same combination of processing taxes, benefit payments, and producer contracts that was applied to most other basic commodities. A distinctive feature in 1933 was a series of marketing agreements negotiated with the principal domestic manufacturers, who agreed to purchase in the 1933 marketing season specified minimum quantities of the types covered, at prices which would average up to or above specified levels. For some kinds of tobacco, these agreements covered substantial percentages of the whole crop. In other instances, they applied chiefly to low grades and insured byproduct outlets for this tobacco at stipulated minimum prices.

Since invalidation of the production-adjustment approach, tobacco growers have participated in the general agricultural conservation program. This program has provided for special acreage allotments and rates of payment with respect to tobacco. For fire-cured and dark air-cured tobacco it has been supplemented by Government loans, and byproduct diversion activities.

In appraising the effects upon prices and incomes received by tobacco producers, it is necessary to consider separately those kinds of tobacco which have such different characteristics that they may be substituted for one another to only a very limited extent, if at all. On this basis, flue-cured, burley, dark air-cured, fire-cured Maryland, and cigar tobaccos were designated as separate basic commodities by the Agricultural Adjustment Administration at the beginning of its operation. A separate program was developed for each, and in the case of cigar tobacco provisions were modified in their application to different types within the group.

For present purposes this same grouping of types is followed, except that dark air-cured and fire-cured are treated as a single group. However, Maryland tobacco is omitted from consideration since the regular adjustment and conservation programs were never applied to this type; the 1934 and 1935 programs were designed only to discourage production of the very low grades. Similarly, cigar wrapper tobacco (shade-grown) and the various minor types commonly reported as miscellaneous are not considered. This leaves four principal groups of types to be examined here. For each of these, an appraisal of the effect on income necessitated the consideration of:

1. The effects upon acreage, production, and market supply.
2. The significance of this modification of supply in influencing price.
3. The influence of the program upon the price obtainable for a given supply.

It is not possible to include the details of these studies in the present report. Instead, the general findings with respect to income effects are summarized, followed by a brief description of the situation for each principal type. Annual estimates of the value of the tobacco crop, with and without the program, are shown in table 21.

TABLE 21.—*Estimated farm value of major types of tobacco with and without adjustment programs, including benefit payments, 1933–34 to 1937–38*

[Dollars in thousands, i. e., 000 omitted]

Marketing season	Without program	With program [1]	Income with program as percentage of income without program
			Percent
1933–34	$131,439	$176,898	134.6
1934–35	138,831	260,231	187.4
1935–36	145,171	246,278	169.6
1936–37	204,116	281,108	137.7
1937–38	255,652	322,064	126.0
Total	875,209	1,286,579	147.0

[1] In addition to the payments included in this total are $360,000 accruing to producers of Maryland tobacco and $4,259,000 to Puerto Rican producers.

When payments for participating in the programs are included, the increase in farm income for the 5 years, 1933–37, approaches $416,000,000. Of this, approximately $327,100,000 was due to enhanced value of the crops. The influence of the program was most noticeable during the period 1934 to 1936, when it was bringing about a sharp adjustment in the total supply of tobacco. Had no program been in operation, a somewhat larger volume of tobacco would have been marketed, especially in the years 1934 and 1935, but prices in all years would have been considerably lower.

Table 22 gives total value added to each type of tobacco by the program for the 5-year period and the total benefit payments.

TABLE 22.—*Increased crop value of tobacco plus benefit payments for specified types, 1933–37*

[Figures in thousands of dollars, i. e., 000 omitted]

Type	Value added by program	Rental and benefit payments	Total
Flue-cured	226,000	37,071	263,071
Burley	70,000	26,825	96,825
Dark	23,000	7,958	30,958
Cigar	8,100	12,416	20,516
Total	327,100	84,270	411,370

FLUE-CURED

From 1920 to 1933 inclusive, year-to-year variations in the acreage of flue-cured tobacco showed a fairly close relationship to the prices received by growers in the preceding season, but with a pronounced upward trend in the acreage accompanying any given level of price.

With the prices farmers received over the period 1933 through 1937, there can be little doubt that had there been no programs, the acreage in each succeeding season would have been very much larger than that which was actually harvested. However, in the absence of programs, the course of prices over the period also would have been much different and on the average they would have been substantially lower. In general, the effects of the programs upon production and marketings would have been in proportion to those estimated with respect to acreage. The smaller production in 1934 and 1935, marketing agreements, and anticipations of future programs explain part of the enhanced prices in those years, but do not explain the most important part of the striking increases in the level of tobacco prices. Of greater significance has been the fact that prices have been maintained at levels well above their previous relationship to supplies. It has not been possible to explain this situation adequately on the basis of any developments known to have occurred outside the program.

The answer must be sought in the buying policy of the tobacco manufacturers. With uncontrolled production, manufacturers had been faced with the necessity of lowering their prices to prevent stocks from becoming excessive. But with acreage and output held within reasonable bounds by the programs, buyers were free to base their price policies on other considerations. Through a policy of paying higher prices the industry has been able to protect itself against a

collapse of resale prices and extensive losses on inventories already held, and has also maintained growers' prices at levels well above their former relationship to supplies. To the extent that the program has made this possible by removing the threat of increased production in response to higher prices, it may be said to have been responsible for the observed enhancement of prices.

BURLEY

In its more important aspects, the situation to be encountered with respect to burley tobacco is quite similar to that already considered for the flue-cured types.

Proceeding along the same lines of analysis employed with respect to flue-cured tobacco, it is concluded that the adjustment program was responsible for substantial curtailments of burley acreages in both 1934 and 1935. Similarly, it is concluded that its effect in curtailing acreages in 1936 and 1937 below those which would have been grown if there had been no program in any year was probably much less, although the program appears to have checked effectively the expansion which would otherwise have been expected to accompany the prices growers actually received.

The adjustment in acreage resulted in lower production of tobacco at the time when stocks were especially large. This resulted in an adjustment in total supplies which was followed by lower stocks so that a more normal relationship of supply and demand was reestablished.

These curtailments of acreage and production were significant factors in strengthening the market, particularly in 1934 and 1935. Again, however, it does not appear that such influences could have been responsible for the whole increase in prices which actually took place, since prices from 1933 on have been consistently above their former relationship to supplies. For the reasons which were outlined with respect to flue-cured tobacco, this maintenance of prices above their usual relationship to supplies is attributed to conditions most largely brought about by the program.

Consumption and exports of burley averaged 13.5 percent greater in the last 4 years than in the preceding 4-year period. This condition favored an increase in price over the pre-program period and must be recognized as entirely independent of any influence which the program may have had on burley tobacco prices and on income from tobacco.

DARK AIR-CURED AND FIRE-CURED

Year-to-year variations in prices usually have been followed by roughly parallel changes in succeeding acreage and production. Contrary to the situations described for flue-cured and burley types, there was no discernible trend in the level of this relationship over the period preceding the introduction of the adjustment program. From 1934 onward, however, acreages have been substantially below their previous relationship to prices, indicating that the program has kept production about 30 percent smaller than it would have been with the prices received. But with no program in any year the evidence at hand indicates that prices would have been much lower, so that there would have been some decrease of acreage and production without the program. In view of all these considerations, it is esti-

mated that the program altered the course of production during the period 1934–37 and probably curtailed it by something like 10 percent.

Unlike the situations described with respect to the two preceding kinds of tobacco, the influence of the program upon prices for the dark types operated mostly through the effect upon supplies, particularly upon the stocks which otherwise would have accumulated. This operation was supplemented to a degree by the loan and diversion activities.

Diversion programs operated to reduce the surplus stocks of dark tobacco and thus improved the market situation for these types. It is estimated that the diversion programs and the accompanying price-stabilization operations have maintained an average price at least 1.5 cents a pound above what it would have been had there been no diversion program. An additional advantage is seen in the more active market which has resulted because of the removal of surplus stocks, a favorable influence which may continue its good effect during the next few years.

On the whole, it is estimated that the combined effects of all elements in the program have been sufficient to maintain prices during the period 1934 to 1937 at levels averaging something like 30 percent above those which growers would otherwise have received.

CIGAR FILLER AND BINDER

Cigar tobaccos are classified as filler, binder, and wrapper types according to their uses in the manufacture of cigars. The last of these has a high unit value, and is produced in comparatively small volume under highly specialized conditions. Although producers of wrapper tobacco types have been eligible to participate in the program, the wrapper types are omitted from consideration in this appraisal since they present special problems of analysis.

In their general characteristics these tobaccos are similar and from this point of view it would seem they might be treated as one product, but because of some specialized uses, they must be considered separately at certain points in the study. The sharp decline in cigar consumption during 1930–32 greatly weakened the market for these types of tobacco. Stocks of tobacco on hand became excessively high in relation to the lower rate of disappearance, but during the years of the program these have been reduced more nearly in line with present requirements.

Significant price gains are attributable to the program. Acreages and production probably would have declined substantially following 1933 even if there had been no adjustment activities. But the program hastened and increased this adjustment with a corresponding influence upon supplies and upon stocks carried over to succeeding seasons.

VII. THE VALUE OF APPRAISAL

The foregoing analyses are presented with due regard for their limitations. The general recovery program of which the commodity plans were a part was a war with depression, and trying to evaluate too closely the results of each of the individual battles is a difficult and fallible task. Nevertheless, there is genuine value in the practice of instituting conservative and careful studies of the effects of the operations of an action agency of government.

CHAPTER 6

ACCOMPLISHMENTS OF THE AGRICULTURAL ADJUSTMENT ADMINISTRATION TOWARD THE LONG-TIME OBJECTIVES OF SOIL CONSERVATION AND EFFICIENT FARMING

A clear understanding of the soil-conservation problem and of the steps taken in the adjustment programs to meet that problem is best arrived at through a brief survey of its historic and geographic settings. The highly exploitative nature of our past agriculture unquestionably lies behind the situation in which American farmers now find themselves. Gullied landscapes, eroded top soils, and bare slopes prove the intensity and sweep of despoliation of our soil resources.

Many forces have contributed to this situation but two are outstanding: First, the great natural abundance and accessibility of our resources, and second the development among the early settlers of habits of thought and action based on a purely individualistic way of life. This latter tendency was most pronounced in the settlers' attitude toward the land. It early crystallized into the belief that every individual enjoyed a right to the unrestricted ownership and use of a piece of land—to buy, sell, and make use of it as he saw fit. There was little consciousness of the wisdom of sharing private interest with the broad public interest or social interest in perishable sources of human life.

I. THE CHANGE FROM WASTE TO CONSERVATION

The abundance of land, timber, and other resources invited and encouraged lavish use. There was neither thought nor immediate need for conservation. The problem faced by many of the early settlers, in fact, was how best to clear the land. Where rich soil was covered by timber their task was to get their fields cleared with the least effort. They had to clear away the brush or break up the prairie sod, and get the land into cultivation. If the lush harvests of virgin soil began to wane after a few years, the settlers moved on and carved out another farm in another locality with equal or greater fertility. So long as free land was available for the asking, with an apparently boundless frontier to the west, they continued to do this. There was little individual incentive to do anything else.

Such an environment does not foster or encourage a sense of stewardship in land, or a feeling of social responsibility in its handling. On the contrary, it encourages reckless prodigality. Attitudes and habits of thought develop which culminate in customs, traditions, and

institutions; and all of these are passed on from generation to generation. Even after those who till the land begin to acquire, through their affection for the soil and their own observation of its wastage, a strong sense of social interest in these resources, those nonfarm groups which profit from intensive exploitation of resources cling to their individualistic ideas.

The abundance of resources and this individualistic attitude toward land and timber, minerals and water, were the major factors in determining the public land policy we have followed until recent years. Except for making land available in convenient units, this land policy has been characterized by an almost complete absence of any positive effort to give rational direction to land use or settlement.

THE AWAKENING IN THE TWENTIES

Although many specialists and a few far-seeing statesmen had long recognized the dangers and inevitable human loss that would result from this policy, it is only within the past few years that the Nation as a whole has come to realize it. In fact, the danger signals first began to attract general attention around the turn of the century. At that time, the last of the good free land was being taken up. The frontier, as it had been known for a century, disappeared. This Nation at last had a preempted continent. It was finally face to face with the problems of a maturing country.

But it really was not until the 1920's that the Nation seemed to have fully sensed the situation. In these years, excessive supplies and low prices accompanied the over-expansion and dislocations of agriculture. The over-expansion was due to the attraction of war-time prices. When these prices collapsed, the continuing loss of foreign markets, the depression in industry, and large scale unemployment brought into sharp focus the seriousness of the problem faced by agriculture and the Nation. The Nation began to count the cost of waste, in all its forms, of our country's natural resources.

The extreme droughts in the 1930's tended further to accentuate the problem so dramatically that the general public could see its meaning more clearly than ever before. The tragic, though spectacular, dust storms in the Great Plains did a great deal to focus public attention upon past misuse. But in the aggregate, they probably were less significant than the insidious and almost imperceptible sheet erosion and loss of fertility going on steadily on the millions of individual farms of the Nation.

THE NECESSITY FOR UNITED ACTION

This general problem is one which the farmers, working as individuals, have been unable to meet. The reasons why are readily apparent to anyone who examines the general nature of the problem and the pressure which economic forces bring to bear upon the individual producer.

Under conditions of unlimited competition in agriculture, the immediate economic interest of the individual producer frequently is in direct conflict rather than in accord with his long-time interests. His long-time interests are closely allied with the permanent interests of the rest of society, and lie in the conservation of the precious resources

which are the basis of human life and happiness. So long as there is no cooperation among individual producers, and no way to implement their strong group interest in protecting their soil, the conditions of unlimited competition make it to their immediate individual economic interest to produce as large a volume as possible regardless of price and regardless of over-exploitation of soil. This is true because the individual's total production represents such a small proportion of the total agricultural output that it has an almost infinitesimal effect upon the price he receives. His gain in income from increased volume, in other words, is not offset by his loss in income due to the small effect his share has upon the total production and price. Moreover, the largest part of the farmers' costs are overhead or fixed costs, which can not be reduced greatly by curtailing output and must be met out of current income. This is further reason why the farmer feels it is to his immediate interest to produce as large a volume as possible, and it explains why it is that agricultural production remains high during periods of depression and why the individual producer finds himself, without concerted group action, unable to cope with the vicious spiral of declining prices.

This situation is accentuated if, as happens often for many producers, these low prices accompany a heavy debt burden. When farmers have families to support on inadequate incomes, mortgages, interest, taxes, and other fixed costs become especially serious because they have to be met if control of the farms is to be retained. In such circumstances, competitive pressure not only forces an increased acreage of land under cultivation, but it also tends to force more and more intense tillage of the acreage already under cultivation. Such intensive tillage exploits the soil and exposes it to destruction from erosion. It results in the production of a larger and larger proportion of crops requiring large amounts of soil nutrients. It results in substituting crops which are clean tilled, exposing the land to erosion, for hay and pasture that protect and build up the land. In the range areas it leads to overgrazing in an effort to support as much livestock as possible on the limited amount of feed available. In the western Great Plains, it sets in motion the successive overplowing and abandonment of land that lead finally to the tragic waste which is caused by dust storms.

To induce the great mass of farmers to maintain soil fertility and control erosion simply through educational methods is usually impossible, since it often runs counter to their immediate profit interest. To be sure, many farmers who are free of debt and who have sufficient means to discount present income are in a position to use soil conserving methods of farming, and a good many of them do maintain, or even increase, the productive capacity of their farms over a long period. Furthermore, there are some large areas where the farming systems are such as to retain much of the farm land in hay and pasture and, hence, reduce to a minimum the problem of fertility maintenance and erosion control. But this is not the case with most farmers in the commercial crop regions. There the problem is serious. It is serious for the farmer and for the nation. Some kind of concerted action, some large scale cooperative effort, is necessary if adequate conservation is to be achieved.

Up until about 5 years ago, direct group action to influence conservation or modify the production of our great agricultural staples either had not been attempted or was unsuccessful. Prior to this time, State and Federal governments largely limited their efforts to carrying out research and extension work as a means of deliberately influencing production. Apparently such limited efforts assumed that the national interest as well as the interest of the individual farmer would best be served if the methods of agricultural production continued to be shaped entirely by competitive forces, unmodified by large-scale cooperation to recognize and meet great common needs.

Such purely individualistic competition, however, leads to waste rather than conservation of natural resources. This is true for two primary reasons. It fails, in the first place, to resolve the conflict between individual and national interests in conservation; and it fails, in the second place, to resolve the conflict between individual and group interests in an income level high enough so that all farmers can afford to conserve their soil. These two conflicts must be resolved in order to make systematic conservation possible, and resolving them must be the objective of any program that is applicable to farmers generally.

II. THE VARIATION IN REGIONAL NEEDS

Two principal types of action are generally accepted as necessary to attain conservation of farm land. Under certain conditions, conservation can be attained by changing the cropping systems followed—that is, by planting smaller acreages of highly exploitative, intertilled, or depleting crops and by increasing the acreage of the conserving crops such as hay and pasture. Under other conditions, the most effective procedure may be the development of soil conservation practices, particularly of such mechanical practices as terracing, contour farming, basin listing, and strip cropping. No matter which approach is made, practical means must be developed to equalize the sacrifice in immediate cash returns that result from substituting methods of soil conservation for those of soil exploitation.

The Agricultural Adjustment Administration has found it necessary to use both approaches, inasmuch as the situation varies greatly as between regions, localities, and types of farming.

In the South, for example, the present acute soil problem resulted, in part, from the sharp slopes, heavy rainfall, and susceptibility of the soil types to erosion, and, in part, from the pressure of the large population upon the land supply. The population pressure forced a large part of the cropping area into such intertilled and soil-depleting crops as cotton, tobacco, and corn. This in turn created a situation highly conducive to erosion and exploitation. The problem of erosion control in the South remains difficult both because of this continued pressure and because there is no perennial grass that is well adapted to the region. Measures of erosion control must largely consist of planting summer and winter cover crops, of terracing, and contour farming.

In many parts of the Corn Belt, on the other hand, the problem is less acute, partly because of the more level topography and partly because of greater use of land for legumes and grasses. Measures

of control involve, in the main, a shift of the land out of intertilled crops, like corn, into more hay and pasture crops; and the consequent encouragement of seeding and, in the hilly areas, of terracing and contour farming.

In the dairy regions, however, the problem of conservation is not primarily one of shifting present cropping systems. In these areas, there is already a very high proportion of the land in conserving crops, notably in hay and pasture. The problem is one of improving these pasture conditions and following cultural practices which will keep the situation stabilized.

In the wheat areas, the primary problem is to get more land tied down to grass and other cover crops. Inasmuch as the rainfall throughout the territory is uncertain, farming must continue to be of an opportunistic character, but it should be handled in such a way as to restrict the seeding of wheat or keep the land undisturbed when moisture conditions are unfavorable. The problem involves the establishment of a flexible type of farming and the encouragement of cultural practices such as strip-cropping, contour farming, basin listing, and artificial reseeding which will tend to keep the land protected.

In the range areas, there is still a different problem. There such mechanical practices as contour furrowing, water spreading, and the like, are helpful, but they need to be accompanied by proper stocking of the range and the practice of deferred and rotation grazing, so that the grass will have a chance to seed and reproduce itself and thereby be restored and maintained.

To give a brief summary of these overall adjustments needed to obtain conservation, the recommendations that have been made both by farmers and by experts in the 48 agricultural experiment stations are presented in table 23. The recommendations of the technicians were made in a Nation-wide study in 1935 and those of the farmers were made in another Nation-wide effort, the county planning project, beginning in 1936.

TABLE 23.—*Summary of recommendations by technical experts and farmers for changes in the acreages of principal crops to obtain conservation, as compared with the 5-year average (1928–32) acreages of these crops and with the 1937 acreages*

[Figures in millions, i. e., 000,000 omitted]

Crops	Actual acres harvested		Acres recommended by	
	1928-32	1937	Technical experts	Farmers
Corn	103.4	93.8	86.5	94.0
Oats and barley	52.7	45.0	49.4	46.2
Wheat	60.1	64.5	51.7	57.9
Cotton	40.5	34.0	38.4	31.9
Tobacco	1.9	1.7	1.9	1.6
All hay	68.4	66.3	81.4	87.8

Clearly, in the judgment of both the technicians and farmers, if conservation is to be attained, it will be necessary to make a substantial adjustment downward in our major depleting crops and a corresponding adjustment upward in our conserving crops as com-

pared with the 5-year average acreages of these crops. In general, it will be noted that both groups recommend a reduction in corn, oats and barley, wheat, cotton, and tobacco acreages below those reported in 1932, while an increase in the acreage of the hay crops was recommended. A comparison of the acreages recommended by the farmers with the acreages actually harvested in 1937 shows that the acreage of corn harvested and the acreage recommended are almost identical; the harvested acreage of wheat is considerably above the acreage recommended; the harvested acreage of cotton slightly above; and the harvested acreage of tobacco slightly below, whereas the actual acreage of all hay is very markedly below the recommended level.

III. THE EXTENT OF PRESENT ACCOMPLISHMENTS

With this indication of the history and extent of the adjustment problem, the effects of the Agricultural Adjustment programs may be reviewed through an appraisal of the contributions actually made toward its solution.

The appraisal is developed under three heads: (1) The effect in downward adjustment of soil-depleting crops; (2) the effect in increase of soil-conserving crops and practices; and (3) the effect in efficiency of farm operation.

THE EFFECT UPON THE DOWNWARD ADJUSTMENT OF SOIL-DEPLETING CROPS

Under the original adjustment programs an effort was made to control the acreages of corn, wheat, cotton, and tobacco. This effort was directed toward reducing burdensome supplies of these crops so as to bring about an increase in price and income. Although conservation was an incidental objective in this early effort, the provisions with respect to the acreages shifted out of production, and the use to which they could be put, were such as to result in a considerable degree of conservation. Under the Soil Conservation and Domestic Allotment Act, moreover, production control became incidental and conservation became the major objective of the programs.

The extent to which the adjustment and conservation programs have been effective in the downward adjustment of the major soil-depleting crops can be judged at least in part from the data in table 24. The corn program was chiefly effective in the North Central or Corn Belt States. Within this area, the acreage of corn since 1934 has been well below the acreage in the 5-year period 1928–32 or the acreage in 1933. This reduction was due largely to the adjustment program of 1934 and 1935. But it was also due in part to both the conservation program and the increase in the acreage of wheat seeded in 1936 and 1937.

Under the conservation program, wheat and corn were included in a general-crops base along with all other soil-depleting crops except cotton, tobacco, peanuts, and rice. Experience with the program in 1936 indicated that its effect upon corn acreage was very uncertain, since farmers who so desired could expand their corn acreage and cut their small-grain acreage. As a result, a corn limit was estab-

lished in 1937 within the general-crops base as a means of stabilizing the acreage of corn in the Corn Belt.

TABLE 24.—*Acreages of specified crops: Yearly average, 1928–32 and 1934–37, annual, 1932–37*

[Figures in thousands of acres, i. e., 000 omitted]

Crop	1928-32	1932	1933	1934	1935	1936	1937	1934-37
Corn planted	104,128	112,061	108,527	99,806	98,372	100,599	96,483	98,815
North Central	66,273	70,272	67,740	58,314	58,015	61,905	58,804	59,260
South	27,431	30,370	29,750	31,199	29,854	28,284	27,343	29,170
Wheat planted	67,411	65,913	68,485	63,562	69,207	73,724	81,362	71,963
Northern Great Plains	23,095	23,012	23,436	19,627	22,625	24,443	24,234	22,732
Southern Great Plains	24,252	24,243	24,192	23,602	24,762	26,286	30,303	26,238
Pacific Northwest	4,718	4,595	5,628	3,987	4,098	4,909	5,070	4,516
Other	15,346	14,063	15,229	16,346	17,722	18,086	21,755	18,477
Cotton, July 1	41,424	36,494	[1] 29,760	27,860	28,197	30,903	34,471	[2] 30,238
Rice harvested	925	874	798	812	817	981	1,086	924
South	811	764	690	704	717	843	956	805
California	114	110	108	108	100	138	130	119
Tobacco harvested:								
Flue-cured	990	618	921	684	874	864	973	849
Burley	427	410	502	304	280	302	442	332
Dark	276	207	209	198	179	161	194	183
Cigar, binder-filler	134	125	64	50	60	64	76	62
Maryland	35	37	37	36	37	38	36	37
Soil conserving hay: [3]								
United States	50,748	50,730	51,132	48,021	50,326	52,074	50,482	50,226
North Central	24,878	23,297	23,646	21,140	22,777	24,049	21,800	22,442
South	5,950	7,342	7,388	7,698	7,711	8,922	9,010	8,335

[1] Excluding acreage plowed under.
[2] 1933–37.
[3] Includes alfalfa, clover and timothy, lespedeza, sweet clover, and miscellaneous tame hay; soybeans, cowpeas, and velvetbeans grown alone in the South and East Central States, and all sweet sorghums for hay and forage.

NORTH CENTRAL: Ohio, Indiana, Illinois, Michigan, Wisconsin, Missouri, North and South Dakota, Minnesota, Iowa, Nebraska, and Kansas.
SOUTH: North and South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Texas, and Oklahoma.
NORTHERN GREAT PLAINS: North and South Dakota, Nebraska, Montana, and Wyoming.
SOUTHERN GREAT PLAINS: Kansas, Oklahoma, Texas, New Mexico, and Colorado.
PACIFIC NORTHWEST: Washington, Oregon, and Idaho.

The acreage of corn in the South was about equivalent to the 1928–32 acreage in 1937, and was well above this acreage in 1933, 1934, and 1935. The corn problem in the South is quite different from that in the Corn Belt. As indicated earlier, the Southern Region has few soil-conserving crops that require the year-round use of the land. In addition, it has the densest farm population of any major region of the United States and needs a considerable acreage in addition to that normally grown in order to supply food and feed for farm use and consumption. Because of these factors, southern farmers have been encouraged to grow more of the home food and feed crops that are needed to give them a higher standard of living. As a consequence, corn acreage has not been reduced. This situation does not affect adversely the commercial corn producers in other areas because the average corn yield in the South is only about 40 percent of the average yield per acre in the Corn Belt itself, and there is almost no commercial production. Moreover, the downward adjustment in the acreage of cotton has also reduced cottonseed production, so that the supplies of cottonseed cake and cottonseed oil have also been reduced. Since the cake competes with corn as feed, and the chief use of refined cottonseed oil is in the production of vegetable shortenings which compete with lard, the net effect has not been disadvantageous to the Corn Belt.

The acreage of wheat planted was significantly reduced in 1934 under the first adjustment program. In 1935, however, wheat acreage was slightly in excess of the 1928–32 level. The Supreme Court decision in the Hoosac Mills case in 1936 was followed by larger increases in the plantings of wheat than in those of most other basic crops. Even the indirect effect on acreage of the soil conservation program was smaller for wheat than for cotton, corn, or tobacco, because no provision was included for any special goal or limit for wheat plantings. Within a year, wheat acreage increased to an all-time high of 81,362,000 acres planted for harvest in 1937. A study of the regional distribution of wheat acreage indicates that the greatest increase has been east of the one-hundredth meridian. The acreage in the more arid Great Plains and the Pacific Northwest has not shown any marked increase over the 1928–32 level.

The general increase in wheat acreage was due chiefly to the effect of successive droughts upon the harvest and prices in 1933, 1934, 1935, and 1936, to the great incentive such prices gave to plant wheat, and to the absence of restrictions upon wheat acreage as such in the Agricultural Conservation Programs of 1936 and 1937.

TABLE 25.—*Summary of acres diverted and soil-building practices under the 1936 agricultural conservation program, for areas and for total United States*

Soil-building practices	Northeast	Midwest	Southeast	Southern Great Plains
Cooperating acreage [1]—acres	12,342,369	98,340,411	46,830,517	57,266,363
New seedings—do	1,714,484	19,129,358	3,480,551	1,290,933
Green manure and cover crops—do	332,528	656,858	7,000,870	4,976,176
Lime applications—do	594,831	1,154,476	154,685	4,470
Ground limestone equivalent [2]—tons	668,615	2,734,278	215,941	8,414
Fertilizer applications—acres	740,425	192,601	157,912	6,709
Fertilizer applications [2 3]—tons	129,439	19,741	17,722	839
Forest trees planted—acres	2,379	2,161	10,198	6,811
Terracing—do	5,256	21,453	372,368	323,649
Contour listing—do	----------	----------	----------	1,277,302
Controlled fallow—do	----------	3	----------	294,083
Acres diverted [4]—do	587,916	8,769,561	6,009,155	8,721,776

Soil-building practices	Northern Great Plains	Pacific Northwest	Southwest	Total United States
Cooperating acreage [1]—acres	59,984,454	6,420,075	5,419,665	286,603,854
New seedings—do	3,807,478	530,616	313,628	30,297,051
Green manure and cover crops—do	307,768	249,212	163,915	13,687,327
Lime applications—do	115	1,634	----------	2,210,211
Ground limestone equivalent [2]—tons	230	1,634	----------	3,629,112
Fertilizer applications—acres	----------	----------	----------	1,097,647
Fertilizer applications [2 3]—tons	----------	----------	----------	167,741
Forest trees planted—acres	10,065	22	122	31,758
Terracing—do	1,458	----------	4,407	728,591
Contour listing—do	3,458	----------	----------	1,280,700
Controlled fallow—do	1,520,777	716,499	1,053,551	3,584,913
Acres diverted [4]—do	6,842,300	543,453	291,394	31,765,555

[1] Acreage of cropland covered by applications for payment.
[2] Estimated on basis of minimum applications required for payment on acres reported.
[3] Superphosphate, nitrate of soda, muriate of potash, basic slag, and manganese sulfate.
[4] Acres diverted from soil-depleting bases for payment under agricultural conservation program.

NORTHEAST: Northeast region and Delaware, Maryland, Virginia, and West Virginia.
MIDWEST: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, and Kentucky.
SOUTHEAST: North and South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Arkansas, and Louisiana.
SOUTHERN GREAT PLAINS: Kansas, Oklahoma, Texas, New Mexico, and Colorado.
NORTHERN GREAT PLAINS: North and South Dakota, Nebraska, Montana, and Wyoming.
PACIFIC NORTHWEST: Washington, Oregon, and Idaho.
SOUTHWEST: Arizona, California, Nevada, and Utah.

TABLE 26.—*Summary of acres diverted and soil-building practices under the 1937 Agricultural Conservation Program*

Soil-building practices	Northeast	Midwest	Southeast	Southern Great Plains
Cooperating acreage---acres	16,727,511	90,224,749	45,645,693	57,347,647
New seedings---do	2,593,932	16,842,546	4,622,116	1,212,983
Green manure and cover crops---do	719,159	343,489	5,169,773	4,938,636
Lime applications---tons	1,645,494	2,933,260	349,377	43,142
Fertilizer applications [1]---do	288,880	69,247	32,791	2,040
Forest trees planted---acres	6,926	4,069	12,458	1,681
Forest trees maintained [2]---do	5,760	38,508	1,291	2,124
Terracing---1,000 ft	1,761	929	195,739	94,973
Contour and other strip cropping---acres	2,138	1,951		31,036
Contour listing---do				4,643,794
Contour farming---do	442			1,789,346
Controlled fallow---do				3,553,071
Pasture land practices: [3]				
Contour furrowing---do			3,060	88,412
Deferred grazing---do			1,564	
Natural restoration [4]---do				147,874
Weed control---do				9,121
Acres diverted---do	340,331	5,875,857	4,988,701	8,292,044

Soil-building practices	Northern Great Plains	Pacific Northwest	Southwest	Total United States
Cooperating acreage---acres	58,416,761	7,413,237	6,853,743	282,629,341
New seedings---do	2,910,823	532,565	356,905	29,071,870
Green manure and cover crops---do	11,450	121,202	983,786	12,287,495
Lime applications---tons	100	18,467		4,989,840
Fertilizer applications [1]---do	21	3,867	139	396,985
Forest trees planted---acres	9,051	45	1,317	35,547
Forest trees maintained [2]---do	5,365	45		53,093
Terracing---1,000 ft	251		216	293,869
Contour and other strip cropping---acres	339,415			374,540
Contour listing---do	13,792	508	128	4,658,222
Contour farming---do				1,789,788
Controlled fallow---do	5,076,022	776,956	139,609	9,545,658
Pasture land practices: [3]				
Contour furrowing---do	4,911			96,383
Deferred grazing---do	95,496			97,060
Natural restoration [4]---do	115,365	172,845	11,705	447,789
Weed control---do	14,754	19,027	19,891	62,793
Acres diverted---do	6,092,338	490,659	282,608	26,362,538

[1] Phosphate, basic slag, potash, nitrogen, manganese sulfate, and 2,729 tons of gypsum.
[2] Acreage maintained and improved.
[3] Other soil-building practices on farm pasture land: Contour listing 2,811,000 feet, fencing 161,461 rods.
[4] Reseeding pasture and restoration to native cover.

NORTHEAST: Includes Northeast Region States and Delaware, Maryland, Virginia, and West Virginia.
MIDWEST: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, and Kentucky.
SOUTHEAST: North and South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Arkansas, and Louisiana.
SOUTHERN GREAT PLAINS: Kansas, Oklahoma, Texas, New Mexico, and Colorado.
NORTHERN GREAT PLAINS: North and South Dakota, Nebraska, Montana, and Wyoming.
PACIFIC NORTHWEST: Washington, Oregon, and Idaho.
SOUTHWEST: Arizona, California, Nevada, and Utah.

Altogether, the adjustment and conservation programs have had a substantial effect upon the acreage of the major soil-depleting crops. Under the agricultural adjustment programs, especially, the acreages of corn, cotton, and tobacco were maintained at a level well below the average acreage in 1928–32 or in the base period. Under the conservation program, some incidental influence upon acreage has been obtained; but the steady increase in agricultural prices and agricultural income from 1933 through 1937, combined with the effects of the Hoosac Mills decision, tended toward encouraging increased acreages. There is no doubt, however, that the type of acreage adjustment which is now needed, and which will be needed for some time to come to maintain farm income, is also a type of adjustment which can contribute toward conservation of soil fertility.

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EFFECT UPON INCREASING SOIL-CONSERVING CROPS AND PRACTICES

Under the agricultural conservation program, attention has been centered upon encouraging the adoption of soil-conserving and soil-building practices, as well as upon maintaining the acreages of the chief soil-depleting crops at a reasonable level.

A summary of the soil-building practices paid for under the Agricultural Conservation Program from 1936 to 1937, as well as the acres diverted, is given in tables 25 and 26. A study of these tables indicates that the type of practice for which payment has been made differs from region to region. The most important of the practices, however, is the payment for new seedings of soil-conserving crops. Altogether, payment was made for the seeding of about 30,000,000 acres of soil-conserving crops under the 1936 Agricultural Conservation Program, and for the seeding of about 29,000,000 acres under the 1937 program.

The seeding payments have been concentrated in the Mid-West, or Corn Belt, and in the southern cotton region. In the Mid-West, these seedings have largely been needed to replace the acreages of soil-conserving crops killed out by the severe droughts of 1934 and 1936. In the South, these seedings have been chiefly for winter cover crops. These attain sufficient growth in the fall and early winter to protect the land from erosion or leaching until they are harvested as hay or plowed under in the following spring or early summer.

Despite the encouragement which has been given to new seedings under the Agricultural Conservation Program, the acreage of soil-conserving crops as usually reported by the Division of Crop and Livestock Estimates or the Census has not shown a material increase. This is due to three factors:

First, the acreages of soil-conserving crops in the Mid-West were severely reduced by the droughts in 1934 and 1936, so that abnormally heavy seedings were required in order to bring the acreages back to their normal level. Second, the seedings in the South have been chiefly for cover-crop purposes, which is a class of crops not ordinarily included in crop reporting statistics or in the Census. And third, to a considerable extent, seeding payments have been made to farmers for carrying out seeding practices needed to maintain, rather than increase, the acreage of soil-conserving crops.

Liming has been an especially important practice in the Northeast and East Central States, as well as in the eastern Corn Belt. The use of fertilizer in improving pasture and soil-conserving crops also has been important in the Northeast and East Central States. Terracing is chiefly important in the South. Contour listing and fallow control are most important in the Great Plains Region, where wind erosion is the chief conservation problem.

Conservation practices under the range program.—The data with respect to the range practices carried out under the program in both 1936 and 1937 are given in table 27. The range program for 1936 was originally announced in the fall of the year and was necessarily limited to such practices as construction of reservoirs, development of wells and springs, and building of fences, since ranchers

had only about 3 months in which performance could be proved. This first program applied to only 13 States, but it was extended to cover all of the range area in 1937, and payments for deferred and limited grazing, in addition to those already listed, were added.

TABLE 27.—*Range practices performed under 1936 and 1937 Range Conservation Program*

Range practices	1936	1937				
	Total United States	Northern Great Plains	Southern Great Plains	Pacific Northwest	Southwest	Total United States
Cooperating acreage----------acres--	50, 256, 000	44, 083, 931	88, 462, 823	7, 708, 244	14, 298, 364	154, 553, 362
Reservoirs constructed-----cu. yds--	5, 230, 151	5, 982, 980	23, 513, 114	137, 180	1, 750, 098	31, 383, 372
Springs—seeps----------number--	8, 437	3, 181	2, 118	3, 137	3, 204	11, 640
Wells----------do----	[1] 1, 025	290	804	54	163	1, 311
Deferred grazing----------acres--	----------	6, 417, 540	5, 791, 542	306, 645	325, 457	12, 841, 184
Limited grazing----------do----	----------	2, 365, 240	----------	----------	----------	2, 365, 240
Artificial reseeding----------do----	36, 847	41, 234	15, 249	17, 817	6, 560	80, 860
Rodent control----------do----	136, 285	1, 639, 018	1, 786, 608	119, 667	37, 345	3, 582, 638
Contour furrowing----------do----	12, 016	4, 722	55, 104	100	142	60, 068
Rescuing range land----------do----	----------	----------	1, 677, 400	----------	----------	1, 677, 400
Fire guards----------feet--	565, 862	22, 440	7, 092, 540	626, 560	5, 352, 948	13, 094, 488
Fences built----------rods--	2, 524, 632	245, 343	802, 495	170, 472	349, 121	1, 567, 431

[1] 129, 557 feet estimated at 126.4 feet per well.

1936 practices cover States in Western Region.

1937 practices also included ridging land in Oklahoma and Texas, 19,957,000 linear feet; 199 acres forest trees planted and 9 acres maintained in South Dakota; 1,208 acres planted and 50 acres maintained in Nebraska; 13,249 cubic feet tanks and troughs constructed in California; 80 acres sagebrush railed in Idaho.

NORTHERN GREAT PLAINS: North and South Dakota, Nebraska, Montana, and Wyoming.

SOUTHERN GREAT PLAINS: Kansas, Oklahoma, Texas, New Mexico, and Colorado.

PACIFIC NORTHWEST: Washington, Oregon, and Idaho.

SOUTHWEST: Arizona, California, Nevada, and Utah.

In general, the most popular practices under the range program in 1937 in all regions were deferred grazing and the construction of reservoirs. Altogether, grazing was deferred or limited on about 15,000,000 acres of land in 1937, and 20,000 to 25,000 reservoirs were constructed. The construction of reservoirs is in line with the general desire to obtain conservation and water control through the impounding of flood waters at the heads of small washes or streams. In addition, such reservoirs serve as convenient storage for stock water, and so enable a better distribution of range livestock over the grazing area.

Deferred grazing is easily the most important part of the range program from the standpoint of strict conservation. Under this practice, ranchers are required to keep livestock off a certain portion of their range from the start of forage until seed maturity. Since payment will be made in any 1 year for deferring as much as 25 percent of the land in each ranching unit, ranchers can obtain the full seed crop of grass on every part of their range over a 4-year period by deferring grazing on one-fourth of the range each year and rotating the areas deferred. So far, no method of artificial seeding which is either as efficient or as cheap as natural reseeding is known; consequently, the 80,000 acres on which artificial reseeding payments have been made are unimportant compared with the 15,000,000 acres on which deferred and limited grazing were practiced.

EFFECT UPON EFFICIENCY OF FARM OPERATION

Naturally, the effect of the conservation program upon the efficiency of farm operation and on cost of production is hard to measure. While no exact statistical measurement is attempted, both the adjustment and conservation programs have definitely tended to promote efficiency.

One indication of the degree to which this is true is the trend of yields for each of the basic crops since 1933. (See table 28.) For some crops this effect has been obscured by the severe and recurrent droughts which started in 1933 and extended through 1936. The trend in yields of cotton and tobacco, however, have both been markedly upward, with cotton yields averaging 30 pounds per acre higher in the 5 years 1933–37 than was the case in the 5 years 1928–32. Yields of flue-cured tobacco have averaged well above the 1928–32 level, while yields of burley, dark, and cigar tobaccos also have shown increases. The same is true with respect to the yield of rice, which has tended slowly but steadily upward under the program.

Wheat yields have been so much affected by the drought that no conclusion can be reached, and corn yields have been subjected to much the same effect, especially in 1934 and 1936. The yield of corn in 1937, however, indicated that the productive resources of the Corn Belt had at least been maintained, and it seems reasonable to expect some improvement in both corn and wheat yields in the next few years if severe drought does not recur.

TABLE 28.—*Yields per acre of specified crops: Yearly average 1928–32 and 1934–37, annual 1932–37*

Crop	Per acre	1928–32	1932	1933	1934	1935	1936	1937	1934–37
Corn planted	Bushels	24.5	26.2	22.1	14.6	23.4	15.0	27.4	20.1
North Central	do	28.8	31.8	25.7	15.3	27.5	14.6	32.6	22.5
South	do	15.0	15.0	13.3	10.9	14.8	13.2	16.6	13.9
Wheat planted	do	12.8	11.5	8.1	8.3	9.1	8.5	10 7	9.2
N. Great Plains	do	10.5	10.8	5.7	3.5	7.0	3.5	6.0	5.0
S. Great Plains	do	12 1	8.5	5.0	6.6	4.7	6.8	9.4	6.9
Pacific Northwest	do	19.3	19.8	13.8	17.5	20.1	18.3	19.2	18.8
Other	do	15.6	15.0	14.4	14.3	15.2	15.1	15.9	15.1
Cotton under cultivation July 1	Pounds	170.1	170.3	[1] 209.6	165.3	180.3	191.8	262.7	[2] 201.9
Rice harvested	Bushels	46.3	47.6	47.2	48.1	48.3	50.8	49.1	49.1
South	do	43.7	44.3	44.5	43.7	44.7	48.0	46.3	45.7
California	do	65.0	70.9	64.0	76.4	74.0	68.0	70.0	72.1
Tobacco harvested:									
Flue-cured	Pounds	679	605	797	814	928	790	878	852
Burley	do	790	740	753	831	792	727	912	816
Dark	do	778	777	763	877	828	773	848	832
Cigar, filler-binder	do	1,191	1,146	1,130	1,324	1,338	1,378	1,269	1,327
Maryland	do	695	775	600	720	755	820	700	749

[1] Yield per acre July 1 less acreage plowed under.
[2] 1933–37.

NORTH CENTRAL: Ohio, Indiana, Illinois, Michigan, Wisconsin, Missouri, North and South Dakota, Minnesota, Iowa, Nebraska, and Kansas.
SOUTH: North and South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Texas, and Oklahoma.
NORTHERN GREAT PLAINS: North and South Dakota, Nebraska, Montana, and Wyoming.
SOUTHERN GREAT PLAINS: Kansas, Oklahoma, Texas, New Mexico, and Colorado.
PACIFIC NORTHWEST: Washington, Oregon, and Idaho.

An upward effect of the adjustment and conservation programs upon yield is to be expected. Under the current conservation program, farmers have an incentive to retire their poorest acreages from the

production of basic crops, since there is no requirement that average acres be retired. This means that the steepest slopes in cultivation, gullied corners, and the less fertile fields are first to be shifted out of the basic crops and into nondepleting and soil-conserving uses. Such a shift in itself will result in an increase in the average yield as usually reported, even if the actual yield of the land remaining in cultivation were to remain the same as it was before the adjustment and conservation programs. In addition, farmers are inclined to give more attention to a smaller number of acres than to a larger number of acres, since they have relatively more labor available, and they are naturally more interested in obtaining good yields on the smaller acreage.

The programs, furthermore, have contributed to the efficiency of operation by reducing both material and labor costs of production. Obviously, both the outlays for production and harvesting have declined in toto, if not in direct ratio with the decline in acreage resulting from the programs. Thus the programs have tended to bring about greater efficiency in agricultural production, not in the historic sense of extracting and selling the greatest amount of soil fertility in the shortest possible time, but in the sense of an economical and sustained output of a farm plant maintained at its best productive capacity.

IV. SOME PROBLEMS AHEAD

In connection with this phase of its program, the Administration continues to face several problems for which a satisfactory solution has not yet been obtained.

THE PROBLEM OF ACREAGE BASES

One of these is the problem of setting up bases and making acreage allotments. Specifically, the problem is to find the most satisfactory method for allocating acreages as between the several regions, States, and areas. Such a method of allocation should allow for changes in the distribution of production of the several commodities in such a way as to bring the highest development of the resources and advantages of the various regions. Under the original commodity adjustment programs, the base acreages of the different crops were distributed between the several States in proportion to the acreages actually grown in 1932–33, 1928–32, or some other recent period. In a continuing program, this historical distribution is soon out of date and some method must be found to allow for shifts as between areas and States whenever and wherever needed.

The problem of allocating the area or county totals to individual farms is even more difficult. There are two philosophies with respect to this. One of them argues for a historical base, with acreages distributed in direct proportion to past performance. The other argues for a conservation and good farm management approach with acreages distributed on the basis of soil type, recommended systems of farming, and available equipment. The two approaches very often result in a greatly different distribution of acreages as between individual farms.

As previously indicated, the Agricultural Adjustment Administration started with the historical-base plan in 1933 and 1934, but has gradually been working toward a good-farm-management approach. But if good farm management is used as a basis, care must be taken

or it may result in payment of the bulk of funds available for adjustment and conservation to selected groups of farmers for following the same cropping systems they would follow without a program. The result of this would be that the other farmers would be tempted to increase their acreages and again produce the surpluses which break the market and injure everyone concerned.

THE PROBLEM OF ADDITIONAL PRACTICES

Another problem has to do with the segregation of soil-conserving practices regularly used from additional soil-conserving practices. More particularly this is a problem of how best to assure that the payments are made for practices which the farmer would not ordinarily follow with or without a program. Attention already has been called to the fact that under the present program a considerable portion of the payments for practices are made for carrying out practices already being regularly carried on. This is one reason why the acreage of soil-conserving crops has not increased more than it has.

This problem arises because the A. A. A. program does not tell farmers what to do, or how to conduct their farming operations, but does offer grants or payments as inducements to follow farming practices which are beneficial to the whole farming group and to the Nation. Since this is the basis of the program, it is difficult to avoid making the payments to all who meet the conditions, including those who can meet them by merely continuing to farm as they have been farming. Certainly a larger part of the available funds for soil-building practices should be used to obtain additional practices, at least until more satisfactory acreages of soil-conserving crops and a better solution of the soil erosion problem are obtained.

THE PROBLEM OF INCREASED YIELDS

The effects of increasing efficiency of production comprise still another problem, of a kind which grows steadily more serious as the period in which the program is operated is lengthened. As already indicated, the better lands are continued in cultivation and the farmers tend to give increasing attention to this acreage. This tendency has serious implications with respect to the future adjustments in acreage which will be needed to maintain reasonable prices and income. Such increases in yields are likely to come about slowly. They may only offset the slow but steady increase in American population, provided per capita consumption is maintained, and provided foreign markets do not decline still further from their already low level. Nevertheless, the effect of the program on per acre yields and on total production will need to be most closely observed.

THE PROBLEM OF FLEXIBILITY

The final and perhaps the most important problem is this: How can the program be made and kept flexible enough to allow the farmers in each area to develop the systems of farming best fitted to the conditions under which they operate? In connection with any national program the universal demand is for simplicity. For any individual, the simplest program is a program which most precisely

fits his farm. If the program, however, is to fit precisely all individual farms, it must be, when taken as a whole, voluminous and complicated, or else within the framework of national requirements which are few and simple it must allow county committees the latitude and discretion to adapt the program to a multitude of local variations. Yet, to be successful, a national farm program has to be operated in every region with a considerable degree of uniformity. This creates the problem.

The ideal to be sought after is a reasonably simple program, yet one which is, at the same time, sufficiently flexible and adaptable to allow its maximum use by farmers in each area. To the extent that this can be done, participation and the amount of stabilization and conservation obtained will be correspondingly increased.

CHAPTER 7

THE EXPERIENCE IN MARKETING ADJUSTMENT

The activities of the Agricultural Adjustment Administration in improvement of marketing procedures, expansion of markets, and the removal of excess supplies of farm products after they are ready for market naturally have tended to increase in importance with the increase in seriousness of the surplus problem. All of these activities have been directed toward some ultimate solution of that problem, even while their immediate purpose was to help farmers increase their market returns during the current season.

The various programs have differed widely in methods used. In general, however, all the activities may be grouped under four broad types of program: (1) Encouragement of domestic consumption, through purchase programs for relief distribution; (2) diversion programs for increasing export and noncompetitive uses; (3) marketing programs for general crops (chiefly fruits and vegetables); and (4) marketing programs for the dairy industry.

I. ENCOURAGEMENT OF DOMESTIC CONSUMPTION THROUGH PURCHASES FOR RELIEF DISTRIBUTION

Partly from specific legislative guidance, but particularly through the influence of related agricultural legislation and administrative policy, major considerations in the development of purchase programs have included the following principles:

1. Purchases should be made to benefit agricultural producers and to secure supplies for persons on relief.
2. Benefits secured should not be confined to a small number of producers, but should be for the assistance of the entire group marketing the commodity.
3. Monetary benefits secured by growers should be reflected in returns on the entire output and should exceed the Government's expenditures on the particular commodity.
4. Whenever possible the purchases should encourage or supplement some other constructive marketing program by growers.
5. Domestic consumption of agricultural commodities should be increased by distributing supplies which are not likely to be consumed in the absence of a program; by giving products to persons who have not previously consumed them, in the expectation that a permanently enlarged market will result; or by preventing the instability in prices which results in alternately high and low commercial supplies and greater consumer expenditure than is necessary with stable prices.

Additional long-time considerations that have motivated relief purchases have been directed toward:

(a) Directly improving current marketing practices, including those pertaining to grading, packing, and size or quality of shipments;

(b) Preventing increased plantings or perpetuation of uneconomic practices as a result of purchase policy; and

(c) Preventing programs from interfering with maximum distribution of products.

In carrying out the program, many of these general purposes have been given secondary consideration. In practice, monetary aid to growers has been the primary aim. Grower distress or threat of distress has been the principal cause for action; and the removal of a part of the supplies depressing growers prices has been the basic means of aiding growers. In general, therefore, the problem of appraising accomplishments is one of evaluating the effects upon producer incomes and marketing practices, and the incidental effects upon other groups, including those to whom the supplies are distributed.

PURCHASES AS DIRECT AID TO PRODUCERS

The simplest situation for purchase operations is that in which purchase is made merely to relieve the pressure of a very heavy supply upon price. This heavy supply may be the result of increased yields or acreage. In other cases, without increasing available supplies, weather factors may have caused the marketing season of normally noncompetitive areas to overlap. Purchases for relief distribution would then serve to increase demand sufficiently so that grower prices and returns could be established at higher levels.

In another situation there may be important imperfections in the market. When the product is offered for sale in the numerous local markets, growers may not receive prices corresponding to those prevailing in larger market areas. Growers may not have all the market information necessary to maximize their returns, or there may be too few buyers to establish these prices. In this case purchases might be managed not so much to raise the general level of prices for the commodity as to correct maladjustments and assure each seller a fair return in relation to the level of price already prevailing. A variation of this situation may be found where growers must sell through shippers and dealers who assemble, grade, and pack the commodity for commercial sale but charge a high fee for such services. In making purchases under such conditions, the manner in which the price shall be divided between the packers and growers may be stipulated, and thus some reductions in handling charges may be secured.

Sometimes the purchase is designed to affect one particular market use out of the many possible uses of the commodity. For example, it may seek to influence marketing in the fresh form rather than in the canned or dried form which may be relatively noncompetitive. Or it may seek to aid commercial producers in spite of the fact that there are large noncommercial supplies which might be offered for sale if prices were sufficiently attractive. There are a number of

possible results. It is quite probable that in the absence of other restrictive factors, temporary price increases resulting from purchases will increase sales in the channel being affected by an amount equal to as much as the quantity diverted for relief consumption. In other words, the volume sold in secondary or by-product channels, or the quantity going to waste or into inventories, will be reduced. In this case the price in the directly affected market may be no higher than previously, and grower returns may be increased only by the difference between the probable returns in the alternative markets and the commodity expenditure made by the relief purchase.

The utilization of supplies in stores, commercial sales, home consumption, feed, noncommercial production, waste, or secondary commercial outlets varies among commodities. Consequently the actual effect of purchases on prices will depend on the possibility of alternative uses. For commodities such as rice it is apparent that there is relatively little that can be done with the crop other than sell it for food consumption or hold it as stock. The alternative choice for oranges is limited, though by-product outlets have been developing. For potatoes and apples, on the other hand, there is much more flexibility in the possible use of the harvested crop.

Even where the supplies in a particular market use can be expanded by diversion from other possible uses, the objective may be to stimulate grower prices and returns in a single sales channel. Success in achieving the objective will then depend on the price policy adopted and on the nature of the industry organization and its cooperation with the ideals of the purchase.

Another situation within which the purchase program may operate is one in which competition is substantially limited. This is typical of many of the processed commodities. Here there are numerous growers selling to a relatively small number of buyers who process the commodity. The buyers in turn resell the processed commodity in a market in which each seller has a substantial degree of price control. In such cases relief purchases may benefit the processors more than the producers.

In some instances the marketing organization may permit powerful manipulation to depress grower returns during the period of peak production to levels unwarranted by supply and consumer demand factors. Once the producers have sold the bulk of their supplies, efforts may be made to increase prices substantially. In such cases purchase activities may be motivated by a desire to manipulate the market in the interest of growers, and for the definite purpose of offsetting or nullifying manipulative influences already present. A modified form of this situation would be one in which the purchases were made to strengthen the efforts of a producer cooperative which was already attempting the same thing.

PURCHASES AS SUPPLEMENT TO OTHER PROGRAMS

Purchases also may be made to supplement a comprehensive industry program. For example, they may be made in connection with a marketing agreement through which organized producers and market agencies are working out a degree of control over marketing practices, distribution of supply, and prices. In this case a purchase might be made to prevent the entire marketing organization from

breaking down because of a temporary or permanent defect in the industry program. Insofar as they support this marketing approach, purchases may be far more significant than is indicated by the increased demand or reduced commercial supply which they make possible.

For some commodities increased shipments may be induced by the mere announcement of intentions to purchase at some stated level or prices. With large supplies and a declining market, local dealers, wholesalers, and retailers may be unwilling to buy in substantial quantities for future needs because of the prospect of lower prices at a later period and because of the fear that their competitors may secure supplies at lower prices than they. In such instances the announcement of a relief purchase program may immediately remove the uncertainties which have prevented the desirable commercial shipments.

EFFECTS OF PURCHASES ON PRODUCERS

The foregoing market conditions are some of the economic situations within which the purchase programs must operate. Although the scope of this report does not permit detailed quantitative estimates of the effects of all the purchases which have been made, brief preliminary appraisals of results have been made for some of the outstanding programs. The following pages summarize some of the preliminary conclusions that have been reached.

In the case of purchases of prunes, grower prices seem not to have been greatly stimulated by purchases, and the increase in grower income was probably not as great as the amount expended in the prune programs. On the other hand, inventories were reduced and total consumption was increased. Of the various methods of purchase employed, purchases from packers, conditioned upon their purchasing a large quantity from growers at stipulated prices, were apparently the best means of assuring benefits to growers.

In the case of apples, total consumption may have increased and fresh utilization was probably increased by the purchases. Grower returns on the whole were probably not increased by more than the money expended, but in many local areas growers were better able to obtain the "going market" price than they otherwise would have been. Prices for relief purchases were well above the market in many areas. Some progress in developing regional and national approaches to better marketing was apparent. The most effective results in apple purchases, however, appear to be encouragement of better grading and packing, and the introduction of a factor which assured the "going" price to growers in isolated markets.

The dairy-products program has included purchases of butter, cheese, evaporated and dry skim milk, and purchases of fluid milk in the Boston milkshed. Increased returns to growers probably exceeded the total Government expenditures. The technique employed dealt primarily through central-exchange purchases, or through bids from processors. Consequently, producers' responsibility for improving their own situation was not developed. Egg purchases were small compared with production. They were timed to offset abnormal seasonal price declines and the possibility that low prices would result in reduced productive capacity. During purchase periods at-

tention was directed to unusually wide retail-wholesale price spreads, which frequently declined after this publicity.

Cattle purchases in 1936 and cottonseed-oil purchases in 1937–38 were very small as compared with the total volume marketed. They were designed to offset potential price declines as a result of excessively large supplies. They appeared to provide a psychological support to markets that otherwise might have been at least temporarily depressed. The nature of the farmer's methods of marketing cottonseed, as compared with the cottonseed-oil market, makes it doubtful that many producers, especially small-scale producers, could participate in the effects of market price increases in cottonseed oil.

The Arizona, California, Florida, and Texas grapefruit and orange purchases probably increased grower income by an amount substantially in excess of Federal expenditures, and generally supplemented or encouraged Federal marketing agreements. Price methods varied. For Florida oranges in the 1937–38 season, prices paid for relief fruit were well above comparable commercial returns for most of the purchase period, and this may have unduly accelerated shipments. A flexible price, following the commercial market more closely, appeared to be better adapted to the needs of the industry. In California the purchase prices were less frequently above the comparable commercial prices in the 1937–38 season. The nature of the California marketing organization and the needs of the industry seem to warrant the adoption of a "surplus" price approach (i. e., a price below the going market) for purchases.

The potato program appears to illustrate effective use of purchases in aiding an industry through a conservative price position. The activities apparently prevented temporary or unwarranted weakness in local prices or sales, and appear to have been a factor in stabilizing both farm prices and the rate of marketing.

The southern cabbage program was an effective program in terms of timing, improved market practices, and grower prices and long-time results. Prices were comparable to or below the commercial level. Purchases were made so as to prevent a very high peak in the commercial shipments. Direct encouragement was given to improved grading. The industry is now seeking a more permanent means of establishing better marketing practices to supplement purchase activities.

EFFECT OF PURCHASES ON CONSUMERS

Consideration of the effect of purchase programs on consumers and consumer expenditure, like the evaluation of the effects on producers' prices and income, necessitates conclusions about what might have happened in the absence of purchase activities.

The effect of purchases on consumers and on total expenditure by consumers has varied. For apples, total utilization in the fresh form and possibly total consumption increased with little if any effect on consumer prices or expenditure. Consumer expenditure for prunes, and possibly for rice, may have increased slightly. Consumer expenditure for oranges was probably unaffected and may have decreased, with regular consumption reduced by somewhat less than the quantity diverted to persons on relief. Total consumption of oranges was probably larger than it would have been otherwise. A

substantial part of the grapefruit purchase increased total consumption without changing consumer prices or expenditures. Expenditures on potatoes were probably unaffected, and may have decreased because of the greater stability in market prices. Consumer expenditure for dairy products probably increased. The egg program may have reduced consumer expenditures.

So far as programs were successful in increasing grower returns by more than the total relief expenditure, regular consumption (though not total consumption) decreased below what it might have been otherwise. It should be noted, however, that in most cases the actual quantity going to regular consumers was at or near record levels and frequently reached a peak during the period under review. In most cases, preliminary analysis leads to the conclusion that consumer expenditure remained the same or decreased. Whether consumers were worse off, even where their expenditures increased, depended upon whether their incomes were constant, rising, or falling.

A number of new products for home consumption, especially dry skim milk, potato starch, or potato flour, have been made available. New market areas also have developed, especially in the case of citrus.

ENCOURAGEMENT OF DOMESTIC CONSUMPTION

In carrying out the mandate of Congress to encourage domestic consumption by diversion from the normal channels of commerce, much more attention might be given to the means through which this encouragement may take place. For instance, there are many cases where realistic analysis would indicate that the best aid to growers would result from a decision to reduce prices and move into consumption the maximum quantity possible. This is particularly true for some of the nonperishables. Here the problem is not a problem of typical seasonal variation, for in these instances the price fluctuates around the seasonal average largely in accordance with variations in consumer income, exports, and other short-run factors in the market.

The penalties that growers pay for excessive supplies may be twofold: Their returns may be reduced in the particular year of the excessive supply; and, since part of this supply will be held by dealers as inventories, their returns may be adversely affected in the succeeding year or years as well. Growers as well as consumers would gain most if a program were developed with the main objective to move the maximum quantity commercially that would leave the market relatively free for the succeeding crop. The mere decision to purchase may contribute nothing to this end, and may in fact prevent it. Injudicious announcements and promises may result in attempts by growers to hold for prices which cannot be maintained; or purchases may be made use of to remove "weak sellers," with a consequent stiffening in inventory prices. It is obvious, therefore, that if programs are to be successful they must have the close cooperation and understanding of the producer.

There is a place in the purchase procedure for stipulated conditions which would make purchases a premium on increased sales. For nonperishable commodities, relief purchases might be made only in connection with a certain volume of regular commercial sales. In other words, purchase would then be a bonus for increased commercial sales. For every sale of X units commercially, relief pur-

chases might be made of Y units. This would seek to encourage the maximum disposition of the crop compatible with reasonable returns to growers. Such an approach would materially broaden the term "encouragement of domestic consumption" and assure wider benefits from the purchases.

Another phase of the program to increase domestic consumption which could have a greater place in activity is illustrated by the dry skim-milk program. In the South particularly, dry skim milk is a material aid to the diet. Interest is being developed in its commercial sale. Up to the present time, however, there has been very little retail sale, the available commercial product selling for 35 to 80 cents a pound in a few areas. Analysis of the potential commercial use and distribution of the commodity indicates that it is not likely to be a competitor with other milk products, especially if distributed to low-income groups. The experience in distributing this commodity for relief purposes at a total cost which would presumably enable retail sales at about 10 cents per pound means that a real commercial market is available for a product which would have extremely desirable nutritive effects on low-income groups. Purchases could be more distinctly turned into a constructive program for the encouragement of domestic consumption if the industry more carefully studied the methods and results of distributing this commodity to relief families. A subsidy program for retail sales might be adopted. A more progressive step would be for the industry to bind itself, as a condition of further purchases, to make available for retail sale at a price not in excess of 10 cents per pound a certain quantity which would have a direct ratio to the quantity purchased for relief distribution. There is probably room for a similar type of program in connection with the potato-starch and potato-flour program carried out in the current year.

In view of the prospects for very large supplies of both oranges and grapefruit, substantially cheaper marketing costs will have to be devised. The alternative will be for producers to dump very large quantities of their annual production, or to appeal for increasingly large purchase programs. Growers will find it of value to study the comparative cost of the various methods of handling the commodities and comparative returns from sales. Purchases should be looked upon by the industry as an experimental method in finding effective and cheaper means to market their crop.

Industry members should be encouraged to study closely the distribution of commodities to persons on relief. The distribution record on dry skim milk, potato starch and potato flour, and Florida-Texas grapefruit, for example, can be important information to industry groups. They will find that relief commodities have been distributed in areas which previously have received very small quantities, or none at all. It is obvious that it is easier to give away food than to sell it, yet the distribution analysis can be a good supplement to the marketing information of industries which are genuinely concerned with widening their commercial markets, especially among low-income groups.

STABILIZING PRICES

Purchases can aid consumers as well as producers by stabilizing prices. In the absence of programs, consumers have to spend more

money since low prices are followed by high prices and the total expenditure is greater when this happens than it would be otherwise. It may be noted that this happens only under certain specified conditions; nevertheless, this possibility deserves closer attention. Conceivably a storage and purchase program could be devised for such commodities as butter and eggs which, though involving relatively small purchases, would aid consumers as well as producers. It is quite likely that when the necessary conditions for such a program to be economically sound are fulfilled, gross returns to producers might be no greater than they would be in the absence of a program, but on the other hand the returns should be very much more equitably distributed among all producers, and other economical adjustments might be made in production costs that are difficult under unstable prices.

THE PLACE OF PURCHASES IN AGRICULTURAL POLICY

There appears to be a definite place for purchase activities as a supplement to other agricultural programs. In general, their purposes will be to encourage domestic consumption of agricultural commodities and improve grower income. In many cases they may be the forerunner of a marketing agreement or other organized activities among producers to aid in solving their marketing problems. Frequently they can be utilized where institutional factors and lack of understanding prevent the successful adoption of the marketing agreement approach.

The effects of a purchase may be very unspectacular and frequently very small; nevertheless, the contribution may be great. There may be a number of growers in local areas who cannot ever be certain of achieving the so-called market price. There are not enough dealers in such areas to assure competitive conditions, or dealers may delay entering the areas until the most favorable part of the marketing period has been completed. In such instances, methods used in making relief purchases may enable growers to secure the going market price.

In many areas, notably the South, there is a wide field for encouragement in use of grades and grading. Other commercial areas secure premiums on supplies while many of the southern supplies do not clear transportation charges. The agency making relief purchases can be an educative force in improving grading and packing standards in these areas.

Relief purchases can be helpful in relieving what may be called intra-seasonal surpluses for perishable commodities. Weather factors may delay or speed up harvest in various parts of the country, with the consequence that normally noncompetitive areas overlap. Under these circumstances, the majority of the growers may be forced to accept prices on their total crops which are depressingly low, and substantial quantities of the crop may be left unharvested. Removal of a part of the potential commercial supplies at the peak of the shipping season is a means of offsetting the worst effects of an excessive rate of shipment.

Relief purchases may serve to salvage supplies that might otherwise not be sold. Canned commodities which are likely to spoil if held over at the end of the season, and fruit that under quarantine

laws will have to be destroyed, can be purchased and utilized. However, if salvage is to be the objective, care must be taken that the purchases do not hinder regular marketing. Purchases for this purpose should probably be made at the end of the season, and at salvage prices.

II. DIVERSION TO EXPORT AND NONCOMPETITIVE USES

Like purchases for relief distribution, the various diversion plans which have been developed are designed to benefit farmers by disposing of supplies deemed to be excessive. In general these plans seek to shorten supplies and raise prices in the principal channels of trade by diverting to other outlets a larger part of the total supply than they would otherwise absorb. Such outlets include new and prospective uses for the product when they can be found, byproducts, and exports.

EFFECT OF EXPORT AND DIVERSION PLANS

In general, price and income effects depend upon the characteristics of demand in the individual outlets among which diversion is effected. If supplies for the principal market outlet can be shortened by diversion to a noncompetitive outlet in which demand is more elastic, growers' returns will be increased.

In order to evaluate effects of a given program, it is necessary to know the manner in which prices respond to changes in volume in each outlet. But many other considerations must also be taken into account, and in practice the influence of a diversion plan upon the operation of the market may be affected by all of the conditions which were mentioned in relation to the effects of purchases for relief distribution.

An analysis of each individual diversion plan is impracticable in a brief report. Therefore, as in the case of purchases, this account is limited to observations and studies of a preliminary character.

The prune diversion program.—The prune diversion program is a good example of the type of program in which the market trend has been downward for more than a year despite the purchase and diversion programs. As the amounts purchased for relief were in much larger quantity than those involved in the diversion programs, it may be considered that the principal market effect was caused by the purchases. On the other hand, on the theory that any reduction in supplies will cause an improvement in prices, the diversion of several thousand tons of prunes from crops amounting to 200,000 tons or more must have had some beneficial effect on the price. However, in a declining market it is not possible to show a price improvement and it can only be indicated, as a matter of analytical conclusion, that the decline would have been greater, and possibly more rapid, without the assistance given by the diversion program.

The four principal factors in the decline of prices in prunes appear to have been the increasing supplies from large crops over which there was no control, the decrease in domestic demand (probably due to change in public preference in favor of fresh fruits available in increasing quantities), the decline in the foreign demand due to restrictions and financial conditions in foreign countries, and the

changes in consumer income. In the face of these conditions, the improvement of the quality of the packed prunes resulting from the diversion program can be considered an important factor in holding and even improving consumer demand, whereas the weakening of quality standards would have had the opposite effect and would have caused a loss in consumer trade because of dissatisfaction with the quality.

The walnut, pecan, and peanut programs.—The walnut program is essentially an attempt to find a market for a recurring surplus, and while the diversion into shelled walnuts may over a period of time increase the quantity of walnuts consumed because of the ease with which the shelled walnuts can be handled and used in standard food products, it is probable that the expansion in the use of shelled walnuts will eventually cause this article to replace a certain part of the demand for walnuts in the shell. Consequently, diversion cannot be considered a permanent solution of the problem.

In the export program, walnuts must meet the competition of a large production of walnuts in various parts of the world and consequently the export sales become a matter of price competition (except for the effect of the somewhat better quality of the American walnuts). On this basis the export program is not a permanent solution unless the Government policy is for continuous subsidies on this article.

In the pecan programs the benefits paid were all on exports whether the pecans were exported unshelled or shelled. Here, as in the case of walnuts, the main objective is the removal of the surplus pecans from the domestic market. The competitive situation in foreign markets is entirely different from that of walnuts, since, except for a small quantity produced in Mexico, the world supplies come entirely from the United States. This presents an opportunity for the sale in foreign markets of an article which was heretofore practically unknown, and it can be considered that the benefit payments are a temporary measure to aid in the establishment of permanent markets abroad. On this basis, the benefit payments should be gradually reduced and finally eliminated when the permanent markets have been established.

The peanut diversion programs are a completely different type dealing with an annual crop which may be increased or decreased by factors quite apart from the marketing situation for peanuts. In fact, studies of the peanut situation result in a quite clear indication that the plantings of peanuts are influenced largely by the price of cotton and by cotton market prospects. In addition to the current price relationship, there is still the necessity of determining the effect of reductions in the cotton acreage which may easily cause a further increase in the peanut crop by making more land available.

Consequently, the peanut plans were designed essentially to save the producers from ruinous prices which may be expected when an attempt is made to market supplies which are considerably in excess of the demand. In the last program covering the 1937 crop the quantity of peanuts diverted was about 12 percent of the total crop, but the diversion of this quantity from the normal markets has made it possible for the producers to maintain prices at reasonable levels so that the producers were benefited in crop income to an amount

several times that which will be expended on the program. Failure to divert the percentage mentioned would have left a pressure of excess supplies which undoubtedly would have resulted in a severe decline in prices on the whole crop.

It should be noted, also, that the product into which the peanuts were diverted is clearly noncompetitive with peanuts as nuts or with the regular by-products such as peanut butter, etc., while the amount of peanut oil produced under the diversion is actually a negligible quantity when compared with the other edible oils available.

The pear and coffee programs.—The fall and winter pear program and the Puerto Rican coffee program are examples of diversions to places within United States territory, although the coffee program more nearly resembles an export program because of the geographical separation of the Island of Puerto Rico from the United States.

For fall and winter pears the greatest possibility for expansion appeared to be in the continental United States, and the objective of this part of the program was to develop markets in places where these pears were comparatively unknown, with the possibility that the expansion of these new markets might eventually be sufficient to take up the increase in production. This type of program should be considered to be a temporary help, because at some point these new markets will have to be classed as normal markets, after which the industry must take care of the marketing problems in the present diversion markets in the same manner as in the normal markets.

The orange program.—The orange diversion program for California and Arizona represents assistance to an industry which has for years tried to take care of its own marketing problems through a marketing agreement. In working out its own destinies it has been helped by the fact that one large and several smaller marketing associations together handle 85 percent of the oranges shipped. Texas has had a citrus marketing agreement for the past year which was used to a small extent on oranges. The other principal producing area, Florida, does not have a marketing agreement, and although there are a number of cooperative marketing groups, these groups have not yet come together with any unified plans for their own local production.

While the California and Arizona industry, under the marketing agreement, regulates the weekly shipments into the markets of the United States and Canada and spreads the shipments over as long a period as possible, it was found in 1938 that the combined shipments from all sources reduced prices to a very low level. At the same time, because of the marketing agreement restrictions, the California-Arizona shippers had quantities of oranges left over for which there was no market. The A. A. A., therefore, agreed to a general plan which combined purchases for relief and a payment for diversion into by-products so as to provide some return to producers for the oranges which could not be shipped into the normal markets or exported. On the other hand, if these surplus oranges had been shipped into the regular markets even lower prices might have been received for the whole crop.

The flax programs.—The two programs covering flax are the only programs which have been developed under the present clause (3) of section 32 which seeks to "reestablish farmers' purchasing power

by making payments in connection with the normal production of any agricultural commodity for domestic consumption." The flax programs have as their objective the maintaining of a rather small industry (which includes both farmers and cooperative factories) that has for its purpose the production of an article which was formerly almost entirely imported. The amounts paid to the grower as benefits were intended to increase the returns to a reasonable price based on previous experience and, in a measure, to carry out the provisions of clause (3) by restoring the farmers' purchasing power to that extent.

Problems for the future.—It is not possible to formulate definite diversion and export plans for the future because of the changing conditions and different situations which relate to each of the agricultural products. It is possible, however, to suggest some general approaches which may be followed and to arrive at some conclusions as to the effectiveness of these types of programs.

Before specific references are made to the various problems, recognition should be given to the fact that the program concerns different types of products which may be broadly classified as tree crops and annual crops. In this classification, crops must also include such vines and other plants as will produce new crops each year without further planting.

In tree crops, as a rule, there is a heavy investment which represents the actual cost of planting and bringing the trees to maturity, in addition to paying taxes during a period of several years when there is little, if any, revenue produced from the land.

The surplus production of tree crops today is the result of heavy plantings in times of prosperity and high prices several years ago, and with these new plantings coming into bearing, together with a normal increase in the production of the older trees, the result is continued overproduction in some crops and occasional overproduction in others.

In annual crops, production is subject not only to weather conditions but also to the decision of farmers as to what quantity they will plant each year; and in many cases the maintenance of high production or increases in production are the result of desperate attempts on the part of farmers to find some use for their lands which will bring some net return.

In all types of farm products, whether they be annual or tree crops, plans should not be so sufficiently liberal as to encourage additional plantings of crops already plentiful or in oversupply.

In formulating plans for tree crops, it is desirable to use different methods for those which continually produce more than the consumer demand and those which only occasionally produce such surpluses. For the former type, the industry can be helped by diversion plans but these should be regulated in such manner as to indicate clearly to the industry that payments will not be made indefinitely and that the money to be expended for the benefit of such industry must be reduced both in total amount and per unit payments. In this way the industry will be forced to find for itself a method of improving its situation and will be encouraged to cut off the farms or portions of farms which cannot produce on a low cost basis.

Other types of tree crops have only an occasional surplus which may be due to unusually favorable weather conditions. In normal years the production is about sufficient for the demand at reasonable prices and in years of bad weather may be less than the normal demand. In such cases, some help can be given under section 32 if an excessive crop is so large as to cause such low prices that the total income, even on the increased crop, is less than a fair return.

The annual crops are also susceptible to weather conditions, and when a normal acreage produces an excessively large crop similar benefits can be obtained by the diversion of all or a portion of the surplus. On the other hand, where the crop produced is continually in excess of consumer demands some other remedy must be employed.

BENEFITS AND LIMITATIONS OF THE EXPORT AND DIVERSION PROGRAMS

The description of the various export and diversion plans under section 32 and the conclusions drawn as to the benefits thereof indicate that the diversion and export plans have been of value to producers. Prices on sales in the normal markets have been improved. In some places markets have been developed for certain products where previously they had been practically unknown, and in other places consumption has been stimulated. In a few cases export markets have been developed to an extent that should result in a permanent increase in exports. Moreover, certain industries have become conscious of the fact that sales and prices are both increased by the elimination of poor grades and substandard grades from the normal distribution.

An important advantage of the diversion procedure, which is also shared by purchases, is that it can be made quickly available to an industry which is in need of immediate assistance. It is not possible to foresee the situation which will arise in connection with each farm product, either before it is harvested or while the harvest is in progress, but the broadness of the language of section 32 permits the prompt establishment of a diversion, export, or purchase plan, whichever will best meet the needs of the situation.

The appropriation is not sufficiently large to carry out diversion, export, and purchase programs for all of the farm products which are not producing satisfactory returns, and consequently its use must be restricted to projects of moderate size. In the last amendment to section 32, which was included in the Agricultural Adjustment Act of 1938, Congress expressed its purpose on this point by adding the following clause:

> Notwithstanding any other provision of this section, the amount that may be devoted, during any fiscal year after June 30, 1938, to any one agricultural commodity or the products thereof in such fiscal year, shall not exceed 25 per centum of the funds available under this section for each fiscal year.

It is obvious that diversion, purchase, or export plans relating to cotton, grain, and any other of the larger crops could easily use a large part, if not all, of 1 year's appropriation; consequently, the plans for such crops should be the result of special legislation and special appropriations.

In attempting to make adjustments in surplus crops the first principle to be followed is to find, if possible, some means of dis-

posing of the crop which is produced and only secondarily to find a means for adjusting the crop to avoid the surplus. Diversion, export, and purchase plans are very effective for this purpose, especially where the surplus is small compared to the whole crop. In some cases, however, the surplus is so large and continuous that section 32 plans can only be estimated as having prevented the situation from getting worse.

Export programs are limited by the competition from other countries and by the ability of the foreign markets to absorb the additional quantities which are exported under a subsidy plan. Diversion programs are limited by the possibility of finding a market for the byproducts. In the majority of cases markets can be found without difficulty for the quantities which it is necessary to divert, but at other times it is necessary to limit the diversion plan to prevent putting the byproduct market into a similar distressed situation.

Undoubtedly some competitive effect arises when the quantity of a certain byproduct is increased; and it is important that this situation be controlled if the byproduct will cause a direct unfair price competition with a similar standard article. One of the principal advantages to be sought after in diversion programs is the establishment of a byproduct which will continue the use of the farm product over a period of years, thus opening up a new outlet.

III. PROGRAMS FOR GENERAL CROPS

Each marketing agreement, license, or order involves some modification of the economic mechanism of the market and attempts to regulate some aspects of the marketing process. The exact character of this reorganization and control depends upon the economic provisions of the plan applied in each individual case. Hence, the experience with these programs can be evaluated most conveniently by considering the more important types of provisions which have been employed.

The principal economic provisions included in the programs for general crops have related to the regulation of total volume, grades and sizes, and minimum prices and price posting. In addition several programs, particularly in the early period of operation, have included provisions designed to regulate various trade practices and charges of handlers, but these are of less significance and will not be examined here.

VOLUME REGULATION

Volume regulation has been provided for, either directly or indirectly, in all but 1 of the 22 marketing agreements and licenses or orders which have been placed in operation under the auspices of the General Crops Section from its beginning in 1933 through the 1937–38 season. During the 1933–34 season, there were 7 marketing agreements and licenses in operation administered by the General Crops Section. During the 1934–35 and 1935–36 seasons, 18 marketing agreements operated under the supervision of the General Crop Section, and during each of the last two seasons there have been 8 marketing agreements, regulation provisions of which were in operation.

The number of marketing agreements and licenses or orders in operation annually during the five seasons of operation of the General Crops Section, classified by type of commodity and the nature of volume regulation effect, is given in table 29. The figures in table 29 do not include marketing agreements and licenses or orders which were in effect but for which no regulations were issued under the regulation provisions included.

TABLE 29.—*Number of marketing agreements and licenses or orders in operation, classified by type of commodity and nature of volume regulation annually, 1933–34 to 1937–38 seasons*

Type of commodity	Nature of volume regulation	Operation of volume provisions	Marketing agreements in operation for the season [1]—				
			1933–34	1934–35	1935–36	1936–37	1937–38
Nonperishable:							
Canning commodities	Limitation of season	Operated	1	3	2	---	---
Turpentine and rosin	Volume of supplies	Provided but not operated	1	1	---	---	---
Walnuts	Market discrimination	Operated	1	1	1	1	1
Dried fruits	Control of movement from growers to packers.	do	---	2	---	---	---
		No volume provision [2]	---	1	---	---	---
Package bees and queens	No volume regulation	do	---	1	1	1	1
Semiperishable: Citrus fruits	Period-to-period regulation of shipments.[3]	Operated	2	3	1	[4] 2	2
Perishable: Fresh deciduous tree fruits, vegetables, and vine crops.	do	do	1	4	2	4	3
		Provided but not operated	1	3	2	---	1
All commodities	All volume regulation	Operated	5	13	6	7	6
		Provided but not operated	2	3	2	---	1
		No volume provision	---	2	1	1	1
Total			7	18	9	8	[3] 8

[1] 1933–34 relates to commodities marketed in 1933 or 1933–34.
[2] Volume regulation of California dates was implied by use of minimum-price provision.
[3] Does not include the marketing agreement and order for California-Arizona cantaloupes and honeyball and honeydew melons, effective May 20, 1938.
[4] Volume regulation of California-Arizona oranges was discontinued during the period June 5, to Nov. 7, 1937.

The Marketing Agreement and License for Shippers of Package Bees and Queens Produced in the United States is the only marketing agreement and license which does not provide for or imply the use of volume regulation to achieve its purpose. The minimum prices established during 1934 and part of 1935, and price-posting provisions in effect subsequently, were designed to prevent "chiseling" rather than to establish prices which were designed to return producers some "reasonable" return and to maintain which volume regulation was implied in the event it may have been necessary. One other marketing agreement and license, that in effect for California date shippers, did not include a provision for volume regulation though volume regulation was clearly implied in the event supplies became available in excess of the quantities which could be sold at the minimum prices established.

Volume regulation is designed to control the volume of or the movement to market destinations of shipments of a given commodity during a given period of time. It is a type of regulation which un-

dertakes to modify available market supplies for the purpose of increasing grower returns. In practice its application results in surplus pools for nonperishables, in what is considered "orderly flow" to market for semiperishables, and in complete elimination of part of the available supplies in the case of perishables. It is a difficult type of regulation to administer in that it presupposes accurate determinations of available supplies and equitable allotment of the advisable market quantity to shippers on the basis of their holdings of the available quantity.

The effect of low consumer purchasing power upon growers following 1930 was such that large crops in many cases returned growers prices which barely, if at all, covered cash outlays for harvesting and marketing. Under these conditions, the prime objective of growers was to curtail the quantity of supplies marketed to a point at which grower prices and returns would be substantially increased. As conditions of demand improved, however, grower prices increased above the emergency levels and grower returns began to improve. Also, public sentiment, because of rising prices of food staples in 1934, went against reduction of season supplies of any agricultural products. As a result of these factors, the emphasis in marketing agreement programs was shifted from curtailment of supplies to "orderly marketing" of supplies. The principal aim under "orderly marketing" programs has been to market the entire merchantable supply in such a manner as to obtain the largest possible season total returns for growers from that supply.

The transition from volume restriction to volume regulation reflects a transition from an emergency or depression approach to a "long-time" or "normal" approach to the problem of increasing grower returns. The practice of reducing supplies available for market during periods when consumer buying power is higher than at depression levels is likely to be unsound in that it tends to increase prices and grower returns above what may be normally expected for the producing capacity or facilities of the industry whose supplies are reduced, and thereby promotes increased plantings or retards the reduction in producing facilities which may be necessary.

Types of volume regulation.—There have been four principal types of volume regulation placed in effect under marketing agreements and licenses or orders, namely, (1) regulation of the total quantity of the commodity to be marketed during a given season, (2) regulation of the volume going to one outlet in order to divert a larger supply to an alternative outlet, (3) regulation of the flow to market during periods within a given season, and (4) regulations of the movement to destinations.

Quantity Regulation.—Regulation of the total quantity of a given commodity to be marketed during a season has been undertaken in agreements relating to canning commodities, raisins, and turpentines and rosin. Regulations of this nature have limited the quantity of the commodity to be marketed during a given season and have been undertaken only when conditions of demand were such that a smaller total return would have been received for the larger quantity which would have been marketed in the absence of such restriction. When the total quantity of a commodity to be marketed during a season is decided upon by a group of growers, this form of action has a tend-

ency to improve their bargaining position. Generally speaking, processors and handlers are fewer in number and better organized than growers and consequently have a more favorable bargaining position when growers are unorganized.

Outlet Regulation.—Diversion between outlets has been undertaken in the marketing agreement relating to Pacific coast walnuts. Such diversion is possible when a commodity may be marketed in two or more independent markets, and when conditions of demand in these separate markets are such that grower returns may be increased by regulating the flow to each. Pacific coast walnut growers have been able to increase returns from such market conditions by diverting a portion of the merchantable supply from the domestic unshelled market into exports and the shelled market. The demand for walnuts in the domestic unshelled market is less elastic than the demand in the export and shelled channels; consequently, the increase in domestic unshelled price when quantities are diverted from that market more than compensates for the decrease in prices in the other markets because of such diversion. The result has been an increase in total returns for growers. The difficulty of providing equitable treatment for individual growers in pooling returns, however, makes the application of this type of volume regulation extremely limited.

Period Regulation.—Volume regulation was undertaken during the 1934–35 season in marketing agreements and licenses relating to dried prunes and raisins produced in California to effect a regulated flow of the commodities from growers to packers by placing control of a portion of the crop in the hands of grower committees. This surplus pool was designed to improve the bargaining position of growers and to assure growers that packers' margins from the sale of these crops would not be excessive. The grower market for dried prunes and raisins is normally a speculative one and packers tend to buy heavily during the fall months immediately succeeding the harvest of the crop. These marketing programs were instituted on the premise that grower committees, having control of the movement of a portion of the crop, could force packers to distribute their purchases more evenly over the season rather than concentrate their purchases during the earlier part of the season. The latter practice both unduly depressed the grower market and enabled packers to take advantage of whatever rise might occur throughout the season in prices for the commodities. Provisions were made in both of the above-mentioned programs for the diversion of low-grade prunes and raisins from normal trade channels in order to prevent blending of lower grades with the approved grades, thus insuring a high quality of the commodity.

Regulation of the flow to market during periods within a given season has been undertaken, also, in marketing agreements and licenses or orders relating to citrus and deciduous fruits, vegetables, and vine crops. Regulation of shipments from period to period within a season is usually carried out by effectuating decisions on the part of industry committees (subject to the approval of the Secretary) relating to the quantity advisable to be shipped during each period. This advisable quantity is then allotted to shippers, who are permitted to move a portion of the supplies available for shipment during the given period. In the event that supplies available during the sub-

sequent period are in excess of the quantity deemed advisable to be shipped during that period, the process is repeated.

Movement of California Bartlett pears to interstate markets under the California Fresh Deciduous Tree Fruit Marketing Agreement was regulated by means of the "car concentration" plan. This type of program, effective when the commodity can be held in car storage and when there is only one transportation route from the producing area, provides an alternative method of periodic regulation of the volume of supplies moved into market. Under this program, cars were released from the producing areas in an orderly manner and in the order of their time of arrival at "concentration points," while their arrivals at "concentration points" were held in reasonable check when necessary by picking holidays.

A second alternative form of regulation of shipments from period to period is the shipping holiday found in the watermelon agreements. With too many different growing and marketing conditions existing in the watermelon-producing areas for an equitable regulation of shipments to be established, the shipping holiday was instituted in order to prevent excessive movement to markets during any period of time. Experience with this type of regulation indicates that unless regulations can be established to prevent excessive shipments in anticipation and immediately succeeding the holiday period this form of periodic control of shipments lacks effectiveness.

The marketing program established under volume regulation provisions of the California dried prune marketing agreement during the 1934–35 marketing season purported to improve grower prices during the heavy marketing season by controlling the movement of a portion of the crop.

Orderly movement of California dates from growers to distributors was implied in the marketing agreement and license for California date shippers, effective during the 1934–35 season. This marketing agreement provided for minimum prices to distributors, which were to be adjusted on a monthly basis to effect a movement of California dates from growers which would result in maximum grower returns for the crop.

Movement Regulation.—Regulation of the movement to destinations is a form of volume control which has been used once in marketing agreement programs, under the Florida Citrus Marketing Agreement and License during the 1934–35 season. The purpose of this regulation was to allot movement to various market areas in order to promote an orderly movement to all market areas, thereby preventing excessive supplies in some areas in contrast to shortages at the same time in other areas. Experience with this form of volume control, however, indicates that it is not effective because of the possibility of moving the commodity after cars have been received in markets to which they were allotted. Moreover, the fact that marketing areas overlap makes it impossible to block off market areas for the purpose of proration.

The results under volume regulation.—Examination of the operation of provisions in marketing agreements and licenses or orders relating to volume regulations indicates a varying degree of success in each of the marketing agreements. Volume regulations established during the 1933–34 and 1934–35 seasons were primarily emergency

measures. They involved reduction in supplies shipped to markets and were adopted to meet emergency conditions existing during the seasons in which they were in effect. Since that date the approach has been that of providing "orderly marketing" regulations which are more consistent with a long-time point of view.

From the standpoint of influencing market prices and grower returns, the results achieved under volume regulation indicate more success for nonperishable commodities than for other commodities. Limitations of season supplies of California canning asparagus, California cling peaches, and turpentine and resin, appear to have had favorable influences upon grower prices and returns. Also, limitation of season supplies appears to be more effective in increasing grower returns when growers and processors agree upon prices to be paid growers in addition to the quantity of the commodity to be marketed. Unless there is definite assurance that competition among processors will succeed in limiting processors' margins, there is no positive assurance, in the event of a limitation of season marketings of a given commodity, that growers will receive the full benefit of the increase in prices warranted by a restriction of the season supplies.

The marketing program employing market diversion in the case of Pacific coast walnuts appears to have been successful in accomplishing its objective of increasing growers' returns during the seasons in which it has been in operation. It is not equally certain that growers receive the full benefits from a merchandising or surplus pool arrangement applied to the raisin and prune industries. These industries are in the hands of a comparatively small number of packers, and competition is limited.

The sale of tonnage from reserve pools was hampered in the 1934–35 dried prune and raisin marketing agreements by the use of "quota rights" established for packers. A packer was given a quota right in the reserve pool in proportion to his contribution to the pool, and these rights carried on and could not be terminated. Offerings of surplus tonnage, therefore, could not be purchased by packers who did not have quota rights to cover the purchases they desired to make, and, in effect, the control of the sale of these offerings was in the hands of the packers who controlled the substantial portion of the quota rights. It appears reasonable to conclude that tonnage from reserve pools cannot be sold in the best interests of growers when sales to purchasers are defined and limited by quota rights.

Examination of the operation of the marketing agreements and licenses relating to California dried prunes and California raisins during the 1934–35 season indicates apparent increases in returns to California raisin growers as a result of the operation of the marketing agreement and license, whereas California prune growers do not appear to have benefited to the same extent as did California raisin growers. Packers of both California dried prunes and raisins were confronted with heavy carry-overs at the beginning of the 1934–35 season and favored marketing agreement programs in order to protect their investments in their inventories. Thus, in the case of both of these commodities, packers, because of circumstances peculiar to that season, supported marketing programs which from a long-time standpoint may be regarded as designed to improve the bargaining position of growers relative to that of packers.

Volume regulation in the case of semiperishable commodities, of which citrus fruits provide the only example under regulation with the aid of marketing agreements, appears to have been needed only during certain periods, particularly during the Christmas season to effect increases in grower returns. Shipment patterns indicate, from the standpoint of the season as a whole, that shippers from the various producing areas have voluntarily effected some regulation upon volumes of shipments, but that a program of shipment regulation undertaken with the aid of a marketing agreement cannot be expected to materially alter the pattern of shipments over the season as a whole. Although regulation of weekly shipments of citrus fruits throughout the season may be necessary in order to obtain control during specific periods, the tangible or measurable beneficial effects of weekly proration are most evident in relatively short periods during the season. It appears that in order to insure effective proration of citrus shipments, shipments of winter oranges from both California-Arizona and Florida should be simultaneously under regulation. Moreover, volume regulation of grapefruit shipments should include regulation of shipments of grapefruit from both Florida and Texas during the same periods.

Regulation of the volume of perishable commodities shipped to market has not met with the same degree of success as regulation of volume of shipments of semiperishable and nonperishable commodities. Examination of the performance of volume regulation, in the case of fresh deciduous tree fruits, vine crops, and vegetables, indicates that the volume moved under volume regulation has been effectively controlled only in the cases of California fresh Bartlett pear shipments (which were regulated by the "car concentration" program), California Tokay grape shipments during the 1933 season, and movement of Florida celery during the 1937–38 season. All other volume regulations effected for perishable commodities, with the exception of the two "unorthodox" regulations instituted for western Washington and Colorado vegetables, appear to have been ineffective in altering shipment patterns of the commodities involved. From a marketing standpoint, successful period-to-period regulation of shipments from principal commercial areas cannot be consistently effected over a period of years because no principal commercial area can be assured of a sufficient portion of the market to continue volume regulations over a period of time. Shipment data indicate vegetable shipments from competing commercial areas, but no data are available to indicate local production in the principal consuming areas, a production which in some instances appears to be of sufficient importance to influence prices received in the commercial areas. Volume regulation of vegetable shipment implies, because of the extreme perishability of vegetables, volume restriction. It appears reasonable to conclude that volume regulation should be employed only when the supplies of the given vegetable, conditions, and demand are such that growers would suffer greatly in its absence.

REGULATION OF GRADES AND SIZES

Regulation of grades and sizes relates to the designation of grades or sizes of a given commodity which may be shipped during any period of time. Such regulation has been authorized in 11 of the 22

marketing agreements and licenses or orders which have been placed in operation under the auspices of the General Crops Section from its beginning in 1933 through the 1937–38 season. In practice, its application has resulted in designation of given grades of nonperishable commodities which may be processed or shipped during the entire season, and in the designation of given grades or sizes of semiperishable and perishable commodities which may be shipped either during certain periods of time within the season or over the season as a whole.

Grade and size regulation, although permissible under the authority given to the Secretary in the blanket provisions of section 8, paragraphs (2) and (3) of the original Agricultural Adjustment Act of May 12, 1933, was not employed in marketing agreements and licenses relating to semiperishable and perishable commodities until the 1934–35 season. Since that time such regulation has been given increased recognition as a mechanism whereby growers of semiperishable and perishable commodities may increase their returns, and six of the nine marketing agreement programs relating to commodities of this type operating during the last three seasons have employed grade or size regulations. The basis for authorization of grade or size regulation has been clarified by provisions in the Marketing Agreement Act of 1937. Regulation of grades permitted to be marketed has been established in five of the nine marketing agreements relating to nonperishable commodities operating since the beginning of the General Crops Section.

Marketing agreements employing grade and size regulation provisions.—During the 1933–34 season, the first season in which marketing agreements and licenses were administered by the General Crops Section, there were seven marketing agreements in operation, two of which operated with regulations of grades and one of which included provisions for grade-and-size regulation which, however, were not used. During the 1934–35 season, 7 of the 18 marketing agreements in operation included regulations relating to grades of the various commodities which were permitted to be marketed. During the past three seasons, grade or size regulation has been effected in four, six, and five, respectively, of the nine, eight, and eight marketing agreement programs in operation during these seasons.

While primarily designed to regulate volume of shipments, marketing programs in five of the nine industries producing nonperishable commodities for which marketing agreements have been in operation have included regulations relating to grades of the commodity permitted to be marketed.

The marketing agreement program for California cling peaches, operating during the 1933–34 and 1934–35 seasons, included provisions limiting the packing of peaches, with certain exceptions, to No. 1 grade. Likewise, the marketing agreement for canning asparagus grown in California provided grade restrictions on canning in addition to a prohibition against the canning of cull asparagus. The marketing agreement programs for California dried prunes and California raisins, both in effect during the 1934–35 season, included provisions for the removal of substandard prunes and raisins from commercial trade channels. Growers of these commodities wished to prevent the blending of substandard dried prunes with the standard

dried prunes, a practice which led to a lowering of the average quality and, consequently, prices and returns to growers. The marketing agreement program for walnuts grown on the Pacific coast, effective each season since the 1933–34 season, includes grade regulation by requiring packers to sell walnuts which conform with the requirements of Federal standards as "merchantable walnuts." Walnuts which do not meet these standards are diverted from merchantable unshelled channels and sold in shelled channels.

The grade regulations which have been provided for in marketing agreement programs relating to nonperishable commodities have been instituted for the purpose of insuring a higher quality of sales of the product and have accompanied volume regulations of these commodities.

Grade-and-size regulations have been operated in two of the three marketing agreement programs in operation for citrus fruits during the past 5 years. The marketing agreements for both Florida and Texas citrus fruit during the 1934–35 season included regulations prohibiting the movement of low-grade citrus fruit. Grades and sizes of citrus fruit permitted to be shipped were regulated in 1936–37 in Florida and in Texas during the 1937–38 season; but volume regulation of citrus fruits through size regulation, which was attempted in Florida during part of the 1936–37 season, has been found impracticable.

That the regulation of sizes of citrus fruit permitted to be shipped may actually increase total volume of shipments is indicated by performance in Texas during the 1937–38 season. Grade-and-size regulation of citrus fruits has been established both to improve the average quality of the shipments and to prevent losses to growers which might have occurred in the event that available supplies of discounted grades and sizes had been shipped to consumers.

Regulation of grades and sizes of shipments of perishable commodities has been established in 4 of the 10 marketing agreements and licenses or orders relating to commodities of this nature in operation during the past five seasons. Grade-and-size regulation of perishable commodities was not effected in marketing agreement programs, however, until the 1935–36 season, and during the 1935–36 to 1937–38 seasons grade or size regulations have been effected in four of the six marketing agreement programs in effect for perishable commodities.

The Colorado vegetable agreement has used grade-and-size regulations effectively for cauliflower during the 1936 and 1937 seasons. When this type of regulation was first used for cauliflower in Colorado in 1936, it was apparent that the principal objective of such a regulation would be the limited restriction of shipments. Even though the control committee was at first expecting few results from the grade-and-size regulations other than a slight reduction in volume moved to already over-supplied markets, it was found upon arrival of the first few cars that the superior quality of an improved and uniform pack strengthened their competitive position on the market. Reports from buyers and receivers on the terminal markets indicated that they no longer had any hesitancy in purchasing cauliflower out of the marketing agreement area in Colorado as long as grade-and-size regulations were in effect because of the assurance that only

uniformly high grade cars would be delivered. It appeared that an improved demand for a superior pack of Colorado cauliflower, created through the operation of grade-and-size regulation, was of more value to the industry than market advantages obtained through reduction in shipments which had previously been given first consideration, and grade-and-size regulations were continued throughout the season in 1936 and repeated in 1937.

The western Washington vegetable agreement, operating during the 1934 to 1936 seasons, included a provision in 1934 for compulsory grading and inspection on the basis of grades promulgated by the United States Department of Agriculture. In 1935, the agreement was modified and provisions were added permitting the regulation of shipments by grade and size, and grade-and-size regulations were issued for shipments of peas from this area during the 1936 season. The value of compulsory inspection was recognized, and compulory inspection was required throughout the season rather than only during periods in which grade-and-size regulations were in effect, as in most other agreement programs.

Grade-and-size regulations were provided in the amended marketing agreement for California fresh deciduous tree fruits, effective July 20, 1935, expanding the provisions of the earlier deciduous tree fruit agreement which provided for regulation by proration only. Regulation of grades and sizes continued the voluntary limitation, observed by shippers of Bartlett pears since the 1931 season, of shipments of Bartlett pears of a size smaller than 180 per box. In addition, grade-and-size regulations were established for shipments of plums during the 1936 and 1937 seasons. A further modification was adopted in the 1937 season when Bartlett pears were inspected for maturity during the early part of the season and were permitted to be shipped only if maturity requirements indicated by a pressure test were met.

The marketing agreement program for Southeastern watermelons, effective during the 1935, 1936, and 1937 seasons, provides for the regulation of shipments by grade and size, and grade regulations have been effected in each of the three seasons of operation. The use of grade regulations has presented inspection problems somewhat different from those encountered in connection with the operation of other agreements because of the relatively high charges for inspection fees. In 1937, when excessive shipments resulted in prices as low as $30 to $35 per car to growers, the inspection fee of $5 per car represented a very high percentage of the total value of the shipment. In cases where the unit value of the commodity is such that the cost of the inspection is relatively low, there is usually much less objection on the part of the grower and shipper for the payment of the inspection fee.

Results under regulation of grades and sizes.—Grade-and-size regulations established for the above-mentioned perishable commodities have been established on the grounds that the grades and sizes prohibited from shipment would, if permitted to be shipped, have returned growers less than the direct charges of harvesting and marketing the commodities. In addition to prevention of losses, the regulations established had the effect of some reduction in volume of shipments and an improvement in the average quality of ship-

ments. As indicated above, grade-and-size regulations for highly perishable commodities tend to decrease the volume of shipments, and the General Crops Section has taken the conservative approach of basing grade-and-size regulations for commodities of this nature upon prevention of losses.

In view of the difficulties encountered in establishing volume regulation for perishable commodities, a matter already discussed in the section on volume regulation, it appears reasonable that regulation of shipments of perishable commodities is best achieved through regulation of grades and sizes. Moreover, grade-and-size regulation conforms to the usually prevailing grower views that the poorer grades and sizes should be "left at home." Grade-and-size regulation can, in perishable commodities, be used to effect volume regulation; moreover, such regulation does not depend directly upon estimates of quantities available for shipment for its operation.

MINIMUM PRICES AND PRICE POSTING

Minimum price provisions relate to prices below which sales of a given commodity may not be made during given periods of time. Such provisions were established in 6 of the 18 marketing agreements and licenses in operation during the 1933–34 or 1934–35 seasons. Minimum prices were set for a season or for specified periods within a season and related to prices received by growers or to prices received by handlers or processors.

Minimum price provisions were included in marketing agreements and licenses under the authority given to the Secretary of Agriculture in the blanket provisions of section 8, paragraphs (2) and (3) in the Agricultural Adjustment Act of May 12, 1933. Amendments to the Agricultural Adjustment Act of August 24, 1935, however, did not include minimum price provisions in regulations permitted to be issued under marketing agreements and licenses, but did include authorization to issue regulations providing for price posting.

Price posting requires that no shipper may quote, offer for sale, or sell the commodity at prices lower than the prices contained in his posted schedule. In the event of a price decline, shippers may issue new price schedules but are not permitted to quote, offer for sale, or sell the commodity at the new schedule of prices until a designated period of time has elapsed.

Price-posting provisions have been included in only two of the marketing agreements and licenses or orders in operation under the administration of the General Crops Section. The marketing agreement and license for Colorado peaches in effect during the 1935 season employed price posting as its principal provision. The marketing agreement and license for shippers of package bees and queens has employed price posting since the amendment to the Agricultural Adjustment Act, effective August 24, 1935, prohibited the use of the minimum price provision which had been employed in that marketing agreement and license until that time.

The issuance of regulations relating to minimum prices appealed to growers during the early years of the Agricultural Adjustment Administration because of the fact that the establishment of minimum prices provides a direct approach to the achieving of the desired goal of higher prices to growers. In attempting to achieve higher grower

prices through the establishment of minimum price provisions, however, it became apparent that growers did not in all cases give full consideration to economic forces affecting prices. Although all but one of the marketing agreements and licenses authorizing the use of minimum-price provisions included provisions for volume regulation to accomplish and make effective the minimum prices established, it became apparent that in some instances industry groups expected the mere establishment of minimum prices to acccomplish the desired result of higher prices and returns to growers. The possibility of achieving higher grower prices without effective regulation of supplies, and of achieving substantial grower equity when minimum prices could be made effective without providing for allotments to growers, however, soon led to the abandonment of the minimum-price regulations as a means of obtaining higher grower prices and returns.

Pricing measures used in marketing agreements.—Minimum prices were established in marketing agreements and licenses relating to California ripe olives, California cling peaches, and Northwest fresh deciduous tree fruits during the 1933–34 season, and in marketing agreements and licenses relating to shippers of package bees and queens, California date shippers, California ripe olives, California raisins, and Northwest deciduous tree fruits during the 1934–35 season. The establishment of minimum price provisions in marketing agreements and licenses or orders subsequent to August 1935 was prohibited by the amendment to the Agricultural Adjustment Act.

The marketing agreement and license relating to California cling peaches during the 1933–34 season established minimum prices in conjunction with volume-regulation provisions set up in order to make the minimum prices effective; hence, it was founded on an economically sound basis. The volume regulations established, moreover, were the effectively operating forces, and the minimum prices established under these marketing agreements and licenses were made effective by the operation of these regulations. Likewise, the minimum prices established in the marketing agreement and license relating to California raisins, in operation during the 1934–35 season, were made effective by regulation of the volume of raisins offered for sale to packers during that season.

Performance under the minimum prices established in the Northwest fresh deciduous tree fruit marketing agreement and order operating during the 1933–34 and 1934–35 seasons illustrates the difficulties encountered with the operation of a minimum price provision when no effective control of volume is established. During the 1934–35 season, minimum prices were established for given varieties of apples sold f. o. b. in the Northwest region. No minimum prices, however, were established for auction sales of Northwest apples nor were there any regulations upon the volume of apples permitted to be shipped from the Northwest region. When apples, therefore, could not be sold f. o. b. in the Northwest region at prices above the minimum price permitted in the marketing agreement and license, they were shipped for consignment sale and upon arrival at eastern consuming markets were sold at prices determined by conditions of supply and demand in these markets. As a result of these factors,

considerable quantities of apples were sold in eastern markets at prices less on a comparable basis than the minimum prices established f. o. b. The Northwest region and grower returns for these quantities were considerably less than the established minimum prices.

Minimum prices were established, during both the 1933–34 and 1934–35 seasons, to distributors and to growers of California ripe olives used for canning under the marketing agreement and license in operation during these two seasons. Provision for volume regulation was made but volume regulations were not established, with the result that during the 1934–35 season, when the established minimum prices were apparently in excess of what could be received for the supplies available, packers began to sell below the minimum prices or to rebate to buyers in the form of brokerage and advertising allowances.

Minimum prices were established in the marketing agreement and license for California date shippers, in operation during the 1934–35 season. A sudden decrease, however, in the estimated volume of supplies at the beginning of the season eliminated the need for marketing regulation and, perhaps, fortunately eliminated also a test of minimum prices where no control of volume was provided for.

The minimum prices established under the marketing agreement and license for shippers of package bees and queens were maintained from May 1934, until August 1935, when the amendment to the Agricultural Adjustment Act forbade the issuance of minimum-price regulations. Since that time price posting has been in effect for the principal purpose of establishing a marketing mechanism for shippers of package bees and queens. Minimum prices appear to have been instituted in this industry for the purpose of preventing farmers who did not make shipping bees their principal enterprise from entering the market and underselling commercial bee shippers who apparently were quoting lucrative prices. The establishment of price posting since August 1935, which is for the purpose of establishing a pricing system to supplant the former method of correspondence between individual buyers and sellers with no universally known or accepted price during any period, appears to be more justifiable.

Price posting was in effect under the marketing agreement and license for Colorado peaches, in operation during the 1935 season. Peaches shipped from Colorado are sold f. o. b. Colorado, transactions being made by wire between buyers and shippers. Price posting was instituted during this season on the theory that in the absence of some regulation there is a tendency for shippers to underquote their competitors when indications are that the market may become weaker, thereby demoralizing the market. Prices received during the 1935 season were high in view of the large volume of shipments, primarily because of extremely small volumes of peaches being shipped from competitive States during that time. That Colorado peach growers do not consider price posting an effective mechanism for improving market prices and returns in that region is indicated by the fact that the marketing agreement and license has not been in effect since the 1935 season.

Results under minimum prices and price posting.—Results obtained from the use of minimum price provisions in marketing agreements and licenses reveal the impossibility of improving grower prices

and returns in the absence of any effective control upon the volume of the commodity shipped to market. Moreover, in the event that available supplies of a given commodity for which minimum prices have been established exceed the quantity which may be sold at the established minimum prices, grower and handler equity will be insured only by the establishment of a form of proration in which growers or handlers equitably participate in the volumes which may be sold at the minimum prices established.

Establishment of minimum price provisions during the early years of marketing agreements appears to have been a concession to current grower sentiment that low prices were due not to conditions of supply and demand but to unfair tactics of handlers. To establish and maintain minimum prices, therefore, appeared to be the most direct as well as efficient means of increasing grower prices and returns. The mere establishment of minimum prices in the absence of effective volume regulation, however, is virtually as effective as pushing on a rope from the standpoint of increasing grower prices and returns. The economic considerations relating to establishing prices are identical to those involving volume regulation. Moreover, if pricing policies are to be effective, they involve volume regulation and allotments to growers and handlers to establish and maintain substantial equity. The prohibition of minimum-price regulations as a mechanism for increasing grower returns by the amendments to the Agricultural Adjustment Act in August 1935 indicated recognition of the economic implications and difficulties arising from the establishment of minimum prices.

Price posting appears to be a reasonable measure if the intent is purely to insure the spreading of marketing information and not to exert any influence upon the level of market prices. It may be true that a demoralized market can be the result of selling activities of a minority of shippers acting upon information which is not complete or true, and price-posting provisions which prevent this appear to be justifiable. It must be borne in mind, however, that moral suasion exerted upon handlers by price-posting provisions not to reduce prices when prices should decline results in unfavorable repercussions upon growers. Moreover, in the event that the market is declining and attempts are made to prevent this decline through encouraging shippers not to post lower prices, the shipper who violates will increase his returns above those of his competitors. Roughly speaking, it appears that price-posting provisions present industry groups with mechanisms whereby some form of price control may be attempted and probably would be attempted in the event of price declines. Economic considerations, however, reveal the futility of effective price control in the absence of volume control.

Where price-posting regulations can be administered in a manner such as to establish a market price for the given commodity without attempting to influence the level of that price, indications are that price posting would prove of value in a number of industries. In many cases where sales are made on f. o. b. basis and no auction market prices can be used as a representative barometer, no established market price exists and handlers often quote prices on the basis of insufficient knowledge of market conditions. If price posting can be effected so that handlers remain perfectly free to post prices they

wish, perhaps by keeping the identity of individuals posting prices confidential, and no coercive influence is brought to bear upon individual handlers, it appears that price-posting regulations could aid in bringing prices quoted by individual handlers to a focus and thereby promote more orderly price movements in many industries.

IV. THE MARKETING PROGRAM FOR THE DAIRY INDUSTRY

PROGRAMS FOR FLUID MILK MARKETS

The principal provisions included in the programs regulating the handling of milk in fluid milk markets have been (1) the classification of milk according to its use, (2) fixing of prices for milk in each use classification, and (3) the providing of some method of prorating the proceeds among producers. During the years 1933 and 1934, Federal regulatory programs were introduced in 51 milk markets in the United States. A number of these programs were canceled between 1934 and 1937, and during the same time only four new markets were regulated. By the end of 1937 there were 23 marketing areas with Federal programs for fluid milk. (See table 30.) These 23 markets were supplied by approximately 45,000 producers and covered approximately 278,000,000 pounds of milk monthly.

During the years 1934 to 1937, 81 revisions and amendments were made to the programs in effect. Some of these changes were changes in the price provision necessitated by the changing economic situation. Other of the changes were made on the basis of the better understanding of the problems involved in the regulating of the handling of fluid milk. (See table 32.)

Objectives of regulation.—One group has attempted to justify Federal regulation of prices to producers from a farm-relief point of view. This group questions the ability of the competitive system to establish fair distribution of income among the factors of production. The fact that milk producers were in bad financial straits in 1933 was to them a problem that the Government had to solve by directly aiding those producers. The administration in 1933 accepted this philosophy but with not much regard for the direction and control features that were necessary. In 1934 a different concept of the best approach to the problem was adopted. This concept was based on the belief that a freely competitive system in the milk industry prevented economic forces from working themselves out. Those who had this concept were hopeful of curing the ills that had beset the fluid milk industry for many years. They regarded these troubles as being caused largely by the concentration of the competitive factors and the fixing of too high returns to each factor. Their approach was to establish such practices as would control and direct the competitive factors toward the end that they thought the freely competitive system would attain.

TABLE 30.—*Number of markets in which programs were introduced and the number in which programs were suspended or cancelled, by months, 1933–38*

Year and month	Number of new markets entered	Number suspended or terminated	Cumulative total in effect	Year and month	Number of new markets entered	Number suspended or terminated	Cumulative total in effect
1933				*1936*			
August	3	0	3	January	0	0	30
September	2	0	5	February	0	2	28
October	4	0	9	March	0	1	27
November	4	0	13	April	0	0	27
December	2	0	15	May	0	0	27
1934				June	0	0	27
				July	0	1	26
January	0	0	15	August	0	0	26
February	1	0	16	September	1	1	26
March	3	0	19	October	0	1	25
April	6	0	25	November	0	0	25
May	2	0	27	December	0	0	25
June	3	1	29	*1937*			
July	11	0	40				
August	2	0	42	January	0	0	25
September	2	0	44	February	0	1	24
October	1	0	45	March	0	0	24
November	3	0	48	April	0	1	23
December	2	0	50	May	0	0	23
1935				June	0	0	23
				July	0	0	23
January	0	0	50	August	0	0	23
February	0	2	48	September	0	0	23
March	0	4	44	October	0	1	22
April	1	0	45	November	1	0	23
May	0	0	45	December	0	1	22
June	0	1	44	*1938*			
July	0	8	36				
August	0	0	36	January	0	0	22
September	0	1	35	February	0	0	22
October	0	0	35	March	0	0	22
November	0	4	31	April	0	0	22
December	0	1	30	May	1	0	23
				June			

TABLE 31.—*Estimated number of producers and producer-handlers, and total estimated production of milk in markets under Federal supervision, April 1938*

[Compiled from reports of the market administrators and the Bureau of Agricultural Economics]

Market	Estimated number of producers and producer-handlers	Estimated total production (milk equivalent)	Market	Estimated number of producers and producer-handlers	Estimated total production (milk equivalent)
	Number	*Pounds*		*Number*	*Pounds*
Battle Creek	288	1, 804, 926	Quad Cities	1, 148	6, 084, 859
Boston	17, 723	108, 634, 105	San Diego	139	[1] 6, 992, 398
Denver	1, 943	[1] 13, 001, 171	Sioux City	1, 035	3, 458, 221
Des Moines	1, 063	4, 410, 671	St. Joseph	234	1, 775, 616
Dubuque	238	1, 520, 967	St. Louis	5, 066	27, 612, 160
Fall River	363	2, 919, 897	Topeka	236	[1] 1, 923, 414
Fort Wayne	1, 089	3, 054, 600	Twin Cities	6, 209	44, 790, 970
Kalamazoo	380	2, 505, 055	Wichita	444	[1] 4, 751, 703
Kansas City, Kans	249	1, 560, 672			
Kansas City, Mo	1, 628	10, 645, 283	Total	45, 271	278, 775. 289
La Porte County	275	1, 283, 875			
Leavenworth	86	[1] 693, 891	Evaporated milk	114, 411	[2] 377, 984, 200
Lincoln	1, 141	[1] 5, 363, 860	Dry milk	1, 200, 000	[2] 368, 862, 500
Louisville	1, 366	11, 441, 719			
New Bedford	337	3, 170, 165	Grand total	1, 359, 682	1, 025. 621, 989
Omaha	2, 591	9, 375, 091			

[1] Reported in butterfat and converted to milk.
[2] Production of product converted to milk equivalent.

TABLE 32.—*Number of revisions and amendments to programs in effect, by months, 1933–38*

Month	1933	1934	1935	1936	1937	1938
January	0	0	10	0	0	0
February	0	4	5	2	1	0
March	0	3	7	0	1	0
April	0	2	5	1	2	0
May	0	11	9	1	0	0
June	0	12	9	0	0	0
July	0	8	12	0	1	----
August	0	10	10	1	1	----
September	0	10	0	0	0	----
October	1	11	0	1	0	----
November	4	13	0	0	0	----
December	0	11	0	2	0	----
Total	5	95	67	8	6	----

During 1935, and especially since 1936, when orders were first issued, the administration conceived of economic principles as useful tools but also felt that too little is yet known of the details of the milk business to apply such principles with any degree of definiteness. Attempts have been made to guide the thinking in the market along the lines that are thought economically proper rather than to regulate the market along those lines.

Any evaluation of the effect of the fluid milk program would have to consider not only the increase in prices to producers but also the progress made in establishing marketing practices for pricing milk and prorating proceeds to producers, two of the problems which have beset voluntary efforts of producers in establishing stable conditions. The benefits of the continuance of a more efficient price mechanism and other marketing practices cannot be measured in terms of price or income except perhaps over a period of time.

It is practically impossible to evaluate fully the effect of the fluid milk program on prices to producers. The data for the individual markets with respect to receipts and sales of milk show wide trends which can in most cases be accounted for by the trend in compliance with the programs. In other cases the definition of the marketing area has been changed so that the milk of more or fewer dealers has been included. The price data are also imperfect and it would be improper to base any conclusions on them. Dealers who have refused to comply have usually been those with relatively large fluid milk sales so that as they dropped out of an equalization pool the announced blended price would fall but the actual average price paid in the market probably did not.

Although most of the benefits from a license or order have been confined to the market in which it has been effective, its influence has been much more widespread. The price-making forces in any large primary market affect and to a large extent determine the prices paid in secondary markets. For example, the price in the Boston market largely determines the prices that will be paid in the Lowell and Lawrence markets. These little markets are situated between the city of Boston and its supply area. If the price is increased in Boston, producers in these secondary markets tend to shift to the Boston dealers and force a higher price from their own dealers. A correct statistical evaluation would have to consider such effects.

Prices to producers, especially those received for that part of their milk which is used by dealers for fluid use, have been increased. The result has been some increase in returns to producers. The attempt in 1934 to increase prices to producers through a lowering of the margins of dealers was not very successful. To what extent dealers have paid the prices established in the programs cannot be ascertained, but they probably were paid by at least the large dealers, thus forcing other dealers to pay somewhat higher prices than they would have otherwise. The higher prices paid may have been offset partly by some increase in production of milk for the market, mainly from the entrance of new producers but also from some increase in production of regular producers.

Proration of the receipts from the sale of milk to handlers.—After the determination of a proper price for handlers to pay for milk, one of the principal problems in the fluid-milk programs has been to determine on what basis and to what extent producers should share in the receipts from the sale of milk to handlers. Invariably the sales of fluid milk which yield the highest returns are distributed unequally among dealers. Question immediately arises as to the manner in which the producers of a milk market should share in the fluid-milk market. Milk of all producers delivering to a particular handler is usually either physically mingled during the process of preparing it for distribution or treated with no attempt to segregate the milk of any particular producer.

The economic basis for paying uniform prices to all producers similarly situated and similarly delivering to handlers is generally conceded under certain conditions. When the same reasoning was applied to all producers in the market, disagreement arose. Although all producers in the market were supplying the market with milk and in some seasons at least all were necessary to the market, any plan to pay uniform prices to all met immediate objection. Claims for preferential treatment were abundant.

The policy adopted in 1933 and in 1934 tended to disregard any request for special differentials and to consider all producers alike. In most markets it would appear that there is not enough difference in producers and their type of production to make any differentiation except on the basis of their distance from the market. When all milk is delivered to the market there is even less justification for any differentials.

To dealers the basis for pooling should have made no difference. Their cost was fixed according to a classified price basis. A handler with a relatively high percentage of fluid milk sales paid the same price for his milk according to use as did all other dealers. With a market-wide pool he paid the same price for his milk as he would have paid with an individual-handler pool. The only difference between a market-wide pool and an individual-handler pool to the dealer was that he should have paid his extra net receipts arising from his selling more than the average percentage of fluid-milk sales in the market to other producers through a market administrator instead of to his own producers or his own pocket. Dealers usually claimed the payment to the market administrator as an additionl cost of their milk rather than as a part of their cost. Consequently some dealers in every market have been reluctant to pay such amounts,

thus rendering the equalization pool partially ineffective and also breaking down any uniform cost to handlers.

During the last 2 years there has been some tendency to introduce individual-handler pools in some markets. Cooperative organizations have generally been against individual-handler pools and wanted them specifically excluded in the amendments of August 1935. Provision for them was included, but only if three-fourths of the producers favored such a pool whereas only two-thirds' approval was necessary to include a market-wide pool in any order.

There has also been some realization that certain types of producers might be entitled to special consideration. Producers located near the market have in many markets so established their farm operation that they produce a fairly constant volume of milk each month, or in any case take care of their seasonal flush on their own farms. These producers are really carrying their own surplus and should not be compelled to share the surplus of other producers. It has been found that producers who have marketed a rather constant amount of milk from season to season have tended to be associated with dealers who have had a relatively high percentage of fluid-milk sales.

Cooperation with milk control boards.—The question of cooperation and division of authority with milk control boards arose almost immediately in 1933. The New York Milk Control Board offered to work out a cooperative program in 1933. The Government attorneys were of the opinion that the Federal power was plenary and advised against accepting the offer of cooperation from New York. There was very little cooperation in 1933.

In 1934 the policy of the A. A. A. changed toward a definite move to cooperate with the States. Other difficulties then arose. Most of the large dealers who were willing to go along with a uniform plan for all dealers in the market operated in interstate commerce and wanted the Federal Government to regulate all dealers in the market. The smaller dealers were more likely to be operating in intrastate commerce and wanted to be regulated by State authorities if they were to be regulated.

Difficulty in cooperation also arose because all of the Federal programs until recently were set up with a market-wide equalization plan, provision for which was not generally made in the State acts. The Indiana Milk Control Act has now incorporated such a provision, and a cooperative effort has been worked out on that basis in the Fort Wayne, Ind., market. Individual-handler pools offer a wider field for cooperation with State milk boards and several markets are operating with joint orders with that pooling arrangement.

Relationships with dealers.—During the early programs in 1933 when resale prices were being established some dealers were as interested in regulation in a market as were the producers. They had been bothered by the cutting of margins by small dealers and producer-distributors. But since the elimination of retail price provisions they have had no enthusiasm for any program which tends to increase their cost of milk. The recommendations generally were not sought by the Agricultural Adjustment Administration and part of the plan actually adopted in 1934 was to cut the margins of distributors. One could hardly expect them to be sympathetic. But strangely the large distributors until recently have gone along with

the program despite the uncertainty of its legality, despite the lack of complete enforcement on all dealers, and despite the disregard of them in the promulgation of any program in their market.

The dealers have themselves not contributed to better relationships with the Agricultural Adjustment Administration. They have at times refused to present any proposals at public hearings. However, their interest appears to be returning. At the public hearings recently they have presented their cases in a critical but more convincing fashion than ever before. It is not to be denied that their support of a program is to be welcomed. An encouragement in their efforts to present their case will result in the establishment of a sounder and better program.

Producer-distributors.—The relatively increasing margins of distribution in the early years of the depression period after 1929 created among other problems that of the producer-distributor. Many producers located near the market became discontented with their returns and entered the relatively more lucrative field of distribution. Neither the large nor the small distributors receiving milk from producers nor the producer organizations were inclined to take a liberal attitude toward them. Little difficulty was encountered in obtaining unanimity in the idea that a producer-distributor should be treated like all other producers and required to equalize his sales.

No attempt was made in the early days of the program to make any distinction between markets or within the markets as to type of producer-distributors despite the fact that there is a wide difference at least between markets. In the South and West the producer-distributor type of business is one of the most important marketing methods. In Atlanta, Ga., nearly 60 percent of the business is handled by producer-distributors, and in Kansas City, Kans., approximately 50 percent is so handled. In most markets in the East the distribution of milk by producers is relatively negligible. In the Washington, D. C., market there are no producer-distributors, and in New York City less than 1 percent of the milk is distributed by producers.

Within markets there is also a wide difference in type. Some producer-distributors have built up a special grade or quality of milk and have a special trade for their milk. These distributors usually have adjusted their production to supply their particular trade. With a premium milk and a business adjusted to the handling of their own surplus, they have caused little trouble in their markets.

The principal complaints of the operations of producer-distributors arose from the distributors. These complaints were usually directed toward those producers who were induced to enter the distribution field when milk prices fell and distribution margins continued to be maintained. The producer-distributor customarily made his way into the market by offering his milk at cut prices, and as a consequence to some extent the maintenance of prices was jeopardized by this type of operation.

Enforcement of regulation on producer-distributors has been particularly difficult. With the entrance of the State milk-control boards into the resale price-fixing field and a gradual realization that perhaps some producer-distributors should be given exemption, the Fed-

eral program has tended to swing from a complete regulation of them to almost complete exemption of them.

Relationship with cooperatives.—The problem of the relationship with the cooperatives has been particularly fascinating. Theoretically the program would appear to be usurping the functions of the cooperatives and the leaders of that movement would be much against it. In 1933 and 1934 some cooperative leaders were very skeptical, feeling that the Agricultural Adjustment Administration did not give enough recognition to cooperatives. Since 1935, after the passage of the amendments, they have been much in favor of the program and have felt that it had been a decided boost to the cooperative movement.

It was realized by those in the Dairy Section that it was only through cooperatives that any immediate progress could be made. And this realization continued to be important, except for a brief period in 1934, in the program of licenses and new marketing agreements and orders. When the time came to amend the act, this feeling of the necessity of cooperatives had so grown that specific important considerations requested by cooperatives were given them fairly willingly in the amendments. The amended act stated that the "Secretary in the administration of this title, shall award such recognition and encouragement to producer-owned and producer-controlled cooperative associations as will be in harmony with the policy toward cooperative associations set forth in existing acts of Congress, and as will tend to promote efficient methods of marketing and distribution." For some time it has been the policy of Congress to foster the cooperative movement, as is evidenced by the Capper-Volstead Act, the Agricultural Marketing Act, and the Farm Credit Administration. The Agricultural Adjustment Act of 1938 likewise provides for a continuation of this encouragement of cooperatives.

More specifically, the Marketing Agreement Act of 1937 outlines in certain provisions just how the recognition shall be given to cooperatives. The most significant of these provisions is the one which states that, "Whenever, pursuant to the provisions of this section the Secretary is required to determine the approval or disapproval of producers with respect to the issuance of any order, or any terms or conditions thereof, the Secretary shall consider the approval or disapproval by any cooperative association of producers, bona fide engaged in marketing the commodity or product thereof covered by such order, or in rendering services for or advancing the interests of producers of such commodity, as the approval or disapproval of the producers who are members of, stockholders in, or under contract with, such cooperative association of producers." The provision is important because only a two-thirds vote of producers is necessary, and in most cases the cooperative association by its vote can largely determine whether an order can be issued in any particular market.

In the section of the act covering milk marketing agreements and orders there is a provision of decided interest to cooperatives which states that, "Nothing contained in this subsection (5) is intended or shall be construed to prevent a cooperative marketing association qualified under the provisions of the act of Congress of February 18, 1922, as amended, known as the Capper-Volstead Act, engaged in making collective sales or marketing of milk or its products for the

producers thereof, from blending the net proceeds of all of its sales in all markets in all use classifications, and making distribution thereof to its producers in accordance with the contract between the association and its producers: *Provided*, that it shall not sell milk or its products to any handlers for use or consumption in any market at prices less than the prices fixed * * * for such milk."

This provision is the cause of great concern in many markets. It means that an association can consider its share of a market-wide pool as a separate pool of its own and distribute the proceeds among its producers in any manner it wishes. The provision, if correctly used, is of decided aid to cooperatives in meeting their problems. However, in one market this provision was used not too discreetly by cooperatives and the exemption granted them brought about a situation in which each of the associations in the market used its pay plan as a competitive weapon, a purpose for which the exemption was never intended and which tended to break down the market as quickly and decisively as had the competition among handlers.

The relationship between cooperatives and the Federal milk program is much more important than is indicated by these various provisions of the act. A strong cooperative is necessary to an effective program in a market. The Administration has entered no market except on the specific request of a strong, organized group of producers. No attempt is made to solicit marketing agreements and orders. If no request is made it is assumed that the local elements are adequately handling the situation. Once a request is made for a Federal program it has been the experience that only through the cooperative association can the necessary information for the market be obtained. The main difficulty in the relationship with the cooperatives has arisen because of their concept of the objectives of the program. At a meeting of economists in 1935 a representative of an important cooperative stated in reference to the fluid-milk program:

> Milk control operations, of course, can be successful if they keep the price of fluid milk in line with the value of milk in other uses. If, however, this is all that is accomplished by milk control, I see no future place for their operations, since the market can maintain fluid-milk prices in line with the value of competing products without assistance of a milk-control body.

This statement represents an attitude still prevalent among some of the cooperatives with respect to the fixing of prices by the Government. They regard the program merely as a price-increasing device. They have not been particularly interested in any program that attempted only to reform practices in the market other than outright price cutting.

Cooperatives have felt that the act was passed for their benefit and that each cooperative had the right to use it as it saw best. Not until recently has the attitude been that of presenting their problems to the Agricultural Adjustment Administration and asking for aid in their solution. This attitude is being encouraged to some extent by the newly adopted plan of requiring each market to present its proposal for a program to the Secretary and to justify its proposal at the public hearing. The difficulty in getting an agreement in many cases has been that the cooperative has presented a problem and a proposed solution but has been relieved of any responsibility in the justification of its proposal. The necessity for setting down their

ideas and reasons for them will in many cases lead the cooperatives to a more cooperative spirit in accepting other ideas of administration.

Instead of being replaced by the adoption of a Federal program, cooperatives in the markets operating under a Federal program have shown a tendency to increase the proportion of the market controlled by them. Probably the reason for this growth has been the fact that producers have received higher returns and they rightly give much of the credit to the efforts of the cooperatives in asking for, obtaining, and helping to maintain the Federal program in the market.

The fact that cooperatives have grown is very satisfying, for it means that if the functions of the Agricultural Adjustment Administration are discontinued in those markets there will be, in many cases, an organization strong enough to carry on the efforts to promote efficient and stable marketing conditions. Furthermore, the establishment of the legal validity of the program is not going to settle all problems in the markets and the Government is not going to be able to litigate every problem. The cooperatives must continue to accept some of the responsibility of the administration of the programs. The function of the cooperatives in improving the product and establishing and guaranteeing a market for its producers' milk has not been touched. The educational work, the checking of weights and tests, and the assurance to producers of a representation at all hearings affecting their interests are still necessary and important services to be performed by cooperatives.

CHAPTER 8

PROGRESS IN ADMINISTRATION

When the first Agricultural Adjustment Act was approved, the Department of Agriculture was confronted by a series of difficult problems. No cut and dried program had been devised, and the grant of authority to the Secretary of Agriculture was broad enough to include the development of several types of programs. Furthermore, several types of administrative organization were possible.

The leading sponsors of the adjustment program were committed to a democratic type of organization, but there were great differences of opinion as to just what that meant. They were honest differences, arising from the very nature of the program. For instance, it seemed quite necessary to the success of any program to achieve a large degree of unity of action, but—how achieve that without a large amount of centralized planning and operation? If administrative centralization was found to be necessary, how much of it was consistent with the essentially democratic form of operation that was desired?

Other problems soon presented themselves: In a democratic farm program, how much weight should be given to the emergency problems of the farmers as a group when an emergency solution might be in conflict with a permanent solution for the people as a whole? In short, should emergency considerations be allowed to outweigh at times the permanent long-time objectives of a sound agricultural policy? Furthermore, if it were advisable to decentralize the administration of the program as much as possible, what should be the proper relationship between the local administrative groups and the central organization in Washington? What, too, should be the relationship between these local committees and the county agricultural agents or extension service, and between these latter and the Washington organization?

Moreover, if the program was to be successful in building up a unified national farm program, it was necessary to inform the public and the farmers of that program. What should be the attitude and tone of that information? Should it be coldly objective and impartial, and so invite an indifferent reception? Or should it be in part persuasive, designed to bring about participation in and enthusiasm for the program, and so perhaps invite the charge of being propaganda?

Almost from the beginning of the programs the Administration has been faced with the problem of answering these and similar questions. Some of them are still not answered, or are answered only tentatively or in part. But definite progress has been made. The nature and extent of that progress are discussed in this chapter, following a brief outline of the present administrative organization.

I. THE ADMINISTRATIVE ORGANIZATION

The Agricultural Adjustment Administration includes both a central organization in Washington and field organizations covering the various regions to which its programs apply.

The Washington organization[8] is composed of (1) the Office of the Administrator, who heads the entire organization and is responsible directly to the Secretary of Agriculture; (2) a regional division for each of the five main agricultural regions in the continental United States and one for insular regions, each division being under a director, with such assistants and technical specialists as are required for administering the entire program within that region; (3) a division of program planning; (4) a division of information; (5) a consumers' counsel division; and (6) a marketing division which formulates marketing plans and directs their administration. Besides these divisions there are two sections, a sugar section and a records and accounts section, not attached to any division which are responsible directly to the Administrator's Office.

Formerly the organization of the A. A. A. included a legal division but at present all legal aspects of the programs are handled directly by the Solicitor of the Department of Agriculture through a special section of his office. Similarly, various other agencies in the Department of Agriculture perform important functions in the administration of A. A. A. programs, although not as parts of the A. A. A. These include the Bureau of Agricultural Economics, particularly the Divisions of Crop and Livestock Estimates, Farm Management, and Statistical and Historical Research; the Federal Extension Service; and the Soil Conservation Service.

The channel through which the production program is administered in the field consists, at the State level, of a series of State offices. In most regions these are in charge of administrative officers appointed from Washington and responsible directly to the corresponding regional division. In all cases State conservation committees, appointed by the Secretary of Agriculture upon recommendation of the regional director, assist in the conduct of the State office. In one region these committees are in charge of their respective offices.

On the county level, the program is administered by county conservation committees and county agricultural agents under the supervision of the respective State offices. The former are elected by the farmer members of the county conservation associations. Within the county associations and under the county committees are community committees, likewise elected by farmers.

The Federal, State, and county extension services collaborate in handling the program in the field. These make up a parallel organization likewise extending from the Department of Agriculture through to farmers in the various counties. One branch of Agricultural Adjustment Administration activity which is carried on chiefly through this channel is that of county planning. The extension service further assists in directly carrying out the adjust-

[8] The organization outlined here is that which existed during the period covered by this report, the 18 months ending June 30, 1938. Changes brought about by the departmental reorganization in October 1938 will be covered by the next report.

ment program. Likewise, State statisticians of the Division of Crop and Livestock Estimates give direct assistance to the State offices and State committees.

To provide a closer contact with conditions in the field, and to facilitate the dissemination of information about the program, six regional contact offices are maintained and are responsible to the Division of Information.

II. THE IMMEDIATE TASK OF ADMINISTRATION

The complex problems faced by the Administration arise quite naturally from the dual character of its work, which is not only that of administering the immediate adjustments required by the legislation as it is enacted, but also that of administratively adapting these immediate adjustments to the permanent agricultural objectives behind the legislation. Each of these tasks involves a number of administrative duties.

The immediate duties of administration may be summarized under the following items:

1. INTERPRETING THE LEGISLATION AND DETERMINING THE POLICY WITH WHICH IT IS TO BE ADMINISTERED

During the period of A. A. A. operation this task has changed in character, but it has necessarily constituted a phase in administering each law. Under the first Agricultural Adjustment Act the step of determining which methods should be used and the degree of vigor with which they should be applied, while falling within the general category of formulating administrative policy, nevertheless amounted to the determination of the whole character of the undertaking.

Succeeding laws have tended to prescribe more specific forms of action. Thus under the Soil Conservation and Domestic Allotment Act there was little doubt as to the general character of the program contemplated, but virtually all features of its operation still were left for administrative determination. The Agricultural Adjustment Act of 1938, however, goes further and prescribes in considerable detail not only the general form of the program but also the precise way in which it shall be applied. Specific instructions are given for allocating funds; for determining when marketing quotas shall be applied; and for determining quotas, bases, and acreage allotments. Hence, under this law the problem is not one of determining the policy and program to be followed under a broad grant of powers, as was the case in 1933, but is largely one of interpreting the detailed provisions of a program definitely prescribed by law.

2. FORMULATING PLANS OF OPERATION UNDER A PROGRAM

This step includes the whole job of developing the detailed plan of operation to be offered to farmers. With respect to the commodity adjustment plans of the first 3 years it rather typically involved:

a. Analyzing the situation for the commodity to which the particular plan was to apply;

b. Determining the rate of processing tax which could be established and estimating the revenue it would produce;

c. Deciding upon the amount of adjustment in acreage or production which should be sought;

d. Establishing rates of payments to farmers which would obtain their participation, and which could be made from the estimated proceeds of the tax;

e. Working out the principles and methods to be followed in establishing individual farm bases from which the necessary computations, with respect to allotments and payments, could be made; and

f. Preparing instructions, forms, and other necessary administrative details.

For the more recent soil conservation programs, this task of planning has been generally similar, even though the detailed steps involved are somewhat different. These programs have never applied to individual commodities; hence, they require an analysis of the whole farming situation within a region rather than of the situation for a particular commodity as was the case with the earlier undertakings. There is no processing tax, and so no problem of determining rates. But the problem of deciding upon the diversion of crop acreage to be sought is comparable to that of determining how far soil-depleting or surplus crops should be reduced. In addition, there is the work of determining what practices should be encouraged.

Establishing rates of payment to be made for diversion of acreage and adoption of practices; determination of bases or goals; and the working out of instructions, forms, and administrative routine are really no different from the same problems under the adjustment programs.

There has been no essential change in the character of these problems under the provisions of the 1938 legislation. But in addition there is the large task of establishing marketing quotas and of coordinating the provisions of the Soil Conservation plans with these new features of the program. For example, the allotment of soil-depleting acreage must be coordinated with marketing quotas if the program is to operate in a practical manner.

3. PUTTING ACCEPTANCE OF THE PROGRAM UP TO THE FARMERS

However imperfect a program may later prove to be, it probably represents, as a rule, the best program that available information and other conditions permit at the time; therefore, only by making the most energetic attempt to secure the largest possible acceptance of, and participation in, the program can the Agricultural Adjustment Administration carry out the objectives intended by the legislation under which it operates. These laws have never contemplated programs that were perfect from all points of view, but they have definitely established a policy of attempting prompt and effective action. Effective action cannot be attained unless the program is accepted by a large number of farmers.

The promulgation of the program typically involves several types of effort, including the educational work that is described more fully later in this chapter. Material is written, published, and distributed,

explaining the program in detail and showing how it is expected to benefit the farmers who take part. Conferences, meetings, and at times intensive campaigns, are utilized in the effort to inform farmers about the program and make them conscious of the potential advantages to be obtained through participation. The commodity adjustment plans involved the actual signing up of farmers under contracts. While this step has not been needed under the conservation program, there has remained the task of working out the soil-depleting and soil-conserving acreages and soil-building practices for each farm in order to show the individual farmer just how he could receive maximum payments as a participant. In fact, this task is enlarged with the addition of marketing quotas to the programs.

4. SUPERVISING OPERATION

This involves the whole work of administering the programs from the time they are established and accepted to the time when the last payment has been made with respect to that season's operation. Under both the adjustment and conservation programs the principle problems involved have been:

a. Establishing bases and allotments for each individual farm:

b. Issuing necessary regulations covering specific points that arise, or modifying provisions of the program to meet unexpected or unusual developments—for example, modification of the program to help farmers meet the exigencies of drought;

c. Checking the performance of each producer who makes application for payment to see that he has complied with the provisions; and

d. Computing the payments for which each farmer is eligible, and issuing those payments.

5. ANALYZING THE OUTCOME OF COMPLETED OPERATIONS

This means going back to the individual features of the plans adopted and tracing through the manner in which they have worked out; it includes analyzing the difficulties encountered, the effectiveness shown, and the results obtained. Such an analysis then becomes a most important basis for the formulation of succeeding programs. So far this has not been considered a distinct and formal step in administration, but has been handled informally as part of the program conferences to which individuals who have had close contact with preceding operations bring the benefit of their observations.

III. THE LONG-TIME TASK OF ADMINISTRATION

Two different problems of administration are dealt with in this report. One is the problem of working out and operating a program that will meet the immediate situation. The other is the problem of keeping the current program in line with the long-time objectives of national farm policy. These objectives have already been discussed in chapter 4.

In that discussion, three major objectives were seen to be emerging as a continuing trend in national agricultural policy. Two of these—

income adjustment and soil conservation—present administrative problems in which the immediate results merge naturally and logically into the permanent objectives. The dominant administrative problem in each case is the matter of deciding how rapidly the immediate goal is to become a fulfillment of the more remote objective. From the beginning, moreover, the answer to this matter has been indicated, or even prescribed, by the legislation itself.

In regard to the third objective—democratic planning and operation—the legislation has been much less definite, and the approach to the objective has been left almost entirely to administrative discretion. The Agricultural Adjustment Act of 1938 specifies operations which are to be left to the local and county committees, but these operations pertain largely to the immediate seasonal goal.

The legislation provides that the local and county committees shall be democratically elected, but the part that these committees are to play in the democratic planning and working out of national agricultural policy is not specified in the law. Developing an approach to the objective of democracy in planning, therefore, continues to be one of the difficult problems of administration.

It is not enough that the program developed be for the benefit of farmers; it must also be a program by and of farmers. Essential, therefore, to any significant progress in this direction is the problem of uniting farmers in an endeavor to work out such a plan. Large scale participation in the seasonal program may of itself be sufficient for the immediate objective of income enhancement or soil improvement. But the long-time objectives require more than the passive participation of many farmers in the current program; they require a real eagerness on the part of participants to attain the ultimate goal of a stabilized and self-sustaining agriculture through the agencies set up by Congress for that end.

FUNCTIONS OF THE AGRICULTURAL ADJUSTMENT ADMINISTRATION

In a general way there are three distinct views as to the proper function of the overhead organization of the Agricultural Adjustment Administration in its relationship to the farming group, the legislature, and the general public.

The first and more traditional view is that the A. A. A. should be considered solely as having, through the Secretary of Agriculture, a mandate from Congress, to represent the general public in planning and operating its adjustment programs. This view looks upon the authorization as flowing from above; so far as possible, it implies that decisions should be limited to interpretations of the law; and where discretion is permissible, action should be in accordance with established precedent. Under this concept, the demands of democracy would be satisfied through general participation in elections of legislative representatives. The action agency, developed to a bureau of sufficient size, could then "see that the laws are faithfully executed." This first view is that of a centralized, essentially bureaucratic agency, and does not contemplate the utilization of farmer experience and knowledge in determining policies and administering the program.

A second view is that the Agricultural Adjustment Administration should regard its function as entirely, or almost entirely, that of

representing the farm group. An administrative organization based on such a concept would not have any great concern about the public interest, except as that interest was reflected in legislative definitions of and restrictions upon its authority. On the other hand, this view would make full provision for the free expression of farmer sentiment as the most important basis for administrative decisions. Such a concept contemplates a vocational alignment within the A. A. A. Under it, administrative officials would consider it their duty to heed farmer demands within the limits permitted by the law.

Although either of these two concepts is possible under the legislation which has been enacted, and the first, at least, would be consistent with efficient conduct of the immediate task, both if adhered to exclusively are inconsistent with the long-time objectives of the agricultural adjustment programs. It is fundamental to the whole idea upon which these objectives are based that planning shall be effected through the joint efforts of the action agent and the farmers.

The third view as to the position which the Agricultural Adjustment Administration should occupy lies between the two extremes just described. It is the one most clearly reflected in the organization and methods which have actually been developed by the A. A. A. While recognizing that modern conditions demand more active governmental intervention and the greater exercise of authority by a central body than before, the Agricultural Adjustment Administration seeks to counterbalance this centralizing effect by securing not only the consent of farmers but also actual and active farmer participation in administrative processes. This is the two-way track so often referred to by people who are in charge of the Agricultural Adjustment Administration.

This two-way track can be seen clearly running through the relationships between Congress and the Agricultural Adjustment Administration as well as through those between the administrative agency and farmers. Partly because of the increasing complexity of the economic problems of agriculture, administrative people studying these problems are quite often called upon by Congress to help in working out legislation. Administrative people have been relied upon by Congress to convey to its members not only technical information but also information as to the views and wishes of farmers. It is wholly consistent with democracy that legislative proposals be based upon recommendations that have been democratically agreed upon by the farm group. Congress and the administrative workers together have supplied a channel through which the demands, the experience, and the knowledge of farmers have flowed to contribute their part in the making of agricultural legislation.

This third concept of the administrative function visualizes the action agency as the repository of increased central authority in the field of agriculture. But this authority is not to be imposed from outside; it is to be employed by agriculture for its own benefit. It is not to be used to effectuate planning solely from the top down. Instead it is to be exercised with the constant consent and approval of the farmers affected and, insofar as possible, with their actual participation in the administrative process. In this way there would be accomplished within the functioning of the Agricultural Adjustment Administration a desirable balance between interests of the

general public and of the farmer group; between immediate and long-time objectives; between expert knowledge and farmer experience; and between centralization of authority and decentralization in administration.

The centralization of Federal authority in the agricultural adjustment programs has been apparent to everyone and frequently has been the basis of attack by critics. Less frequently perceived, however, and seldom fully appreciated, has been the parallel trend toward decentralization in planning and administration. Actually, the idea of balanced economy has had its counterpart in "balanced administration." Secretary Wallace very early expressed this underlying idea of administration by the simple paradox: "What we need is greater centralization and decentralization."

REASONS FOR FARMER PARTICIPATION IN ADMINISTRATION

Increased centralization of administrative authority has been a self-evident fact accomplished by the farm legislation. But why the attempt to balance this with a parallel emphasis upon requiring that farmers not only give their consent and approval in the determination of policy, but also actually participate in administration?

In a sense the Agricultural Adjustment Administration was committed to the principle of active farmer participation in the administrative process even before the first adjustment legislation was enacted. Leaders of the educational movement in which the idea of long-time agricultural planning originated had already come to the conclusion that such participation was essential to any sound adjustment. In other words, agricultural leaders held that planning could be effected successfully only through cooperation between the designated Government agency and farmers. This principle was retained during the period when the trend of thinking was toward more active public intervention in the economic affairs of agriculture—a trend which led to the development of the modified domestic allotment plan from which many features of the Agricultural Adjustment Act of 1933 were drawn.

When Governor Roosevelt in his speech at Topeka, Kans., on September 14, 1932, stated his position in favor of national planning in agriculture, he laid down certain specifications designed to assure adherence to democratic principles. Administration was to be decentralized so that chief responsibility would rest upon the locality concerned; it was not to result in the development of a large bureaucracy in Washington. The farm program was to operate as nearly as possible on a cooperative basis; make use of existing organization so far as possible; and be voluntary.

This acceptance of the cooperative principle was based upon the belief that if a vehicle for their collective judgment could be devised, the farmers themselves were the ones most qualified to decide what adjustments were needed. In a sense, the struggle to create the agricultural adjustment machinery was a struggle to create the means for formulating this collective judgment. Great progress had been made in collecting and interpreting factual information, but this did not provide an adequate basis for arriving at adjustments which could safely be imposed from above by any overhead authority or

by any power except the power of this collective judgment of agriculture. This body of factual information had to be supplemented by the experience of farmers and their knowledge of local conditions.

Acceptance of the cooperative principle also appears to have been based in part upon the recognition that the traditional independence of the American farmer was a factor so powerful as to make a purely bureaucratic type of administration impracticable. The transition that was under way towards cooperative planning involved considerable encroachments upon the independence of the individual farmer, particularly with regard to any individual activity which was inconsistent with the welfare of agriculture in general. But farm leaders made concessions from individualism reluctantly, knowing that as a rule there was no disposition on the part of the farmer to have his affairs supervised by someone else. Moreover, the farm group was in a position to demand a voice in shaping governmental activity which affected them. During the long period of farm relief agitation, farm organizations had built up powerful followings. In this period a strong independent leadership arose which had to be reckoned with and consulted in the development of any farm program.

More immediate reasons for adhering to the principle of farmer participation became apparent when the adjustment legislation was approved and the task of formulating administrative policies and methods was undertaken. The new program was admittedly experimental, and the Agricultural Adjustment Administration was venturing into new lines of public activity for which no precedent existed. At the same time there was pressing necessity for swift action. Under these circumstances it was clear that only farmers themselves possessed the experience and information which were indispensable to successful development and operation of a program. The decisions facing administrative officials in the exercise of the large powers which had been given them could be made most safely in close collaboration with the farmers who would be affected.

Moreover, this course was politically expedient, both from the immediate and continuing points of view. The heavy responsibilities which were given to the Agricultural Adjustment Administration have frequently placed it in a precarious position. Charges of regimentation and bureaucracy often have been made, and at times these charges have attracted considerable public attention. Under such circumstances it is extremely important as a means of retaining public confidence and the support of farmers that particular actions be taken in accordance with the recommendations of farmers and their accredited leaders. It is probable that criticisms of regimentation would have carried much more weight with the public and the farmers if it had not been for the measures which have been taken to maintain the program in close alignment with the views of practical farmers. In fact, public opinion in all probability would not have permitted a program of such magnitude to be controlled entirely from Washington.

Among the immediate reasons for delegating actual administrative tasks to farmer committees was the fact that in no other way could the necessary organization be set up in time to carry out the program in the first year. It would have been practically impossible to hire and train Government employees for the short-time job that was

to be done. Only people from within the immediate localities could effectively do the work that was required and secure the participation of farmers.

From a longer-time point of view still other reasons are to be recognized. One of these is the influence that local administration exerts in unifying the farm group. Such unification is a long step toward securing the participation, interest, and effective organization which are essential to sustained long-time progress. Equally important are the benefits which farmers receive from sharing directly in the process of administration, from the training and development of leadership, and from the stimulation of interest in farm problems generally.

IV. PROGRESS TOWARD LOCAL PLANNING

It was apparent at the time the Agricultural Adjustment Administration was organized that the goals which were established were limited by different factors. For one thing the adjustments required on individual farms would have to be reasonable in terms of departure from past farm organization. It was also recognized that the adjustments which were needed and which were reasonable varied from farm to farm to some extent, and between different systems of farming and type-of-farming areas to a much greater extent. As a result of these factors, one of the first activities which the Agricultural Adjustment Administration undertook was the study of differences in types of farming as between the several areas and regions of the country. This was done with a view to estimating the type and extent of adjustments which seemed to be needed in the interest of conservation and good farming, and which could reasonably be made from the standpoint of price adjustment. This study has become increasingly complex as material has been accumulated and analyzed, and as the scope of the agricultural program has been widened.

The first step in this work undertaken by the Division of Program Planning was the analysis of the type-of-farming data obtained in connection with the Census of 1930. The Division worked out a combination of the several hundred type-of-farming areas shown by the census into a much smaller number of reasonably homogeneous regions and sub-regions. In this way, a more workable basis was obtained for an analysis of the different systems of farming involved. The agricultural problems of these several regions were then studied and tentative conclusions reached as to the type of adjustments most needed in each region.

The second step in this study was the Division's cooperation with the 48 State colleges and the Bureau of Agricultural Economics in the Regional Adjustment Project of 1935. In connection with this project a committee was organized in each of the 48 State colleges to consider the agricultural problems of the State and to work out adjustment recommendations for each type-of-farming area or distinct system of farming within the State. This material was brought together by type-of-farming regions and summarized. Since 1935 this work has been revised and expanded through cooperative studies with a number of State colleges in connection with certain problems which were especially important or on which new data are needed.

ASSEMBLING LOCAL DATA

Analysis of the technical data available from such sources as the census, studies of the Bureau of Agricultural Economics, and from the State colleges through the regional adjustment work, however, does not by itself present an adequate basis for the determination of area and regional adjustments which are most needed. Experience in planning and administering programs under the old Agricultural Adjustment Act, as well as current experience under the Soil Conservation and Domestic Allotment Act, has demonstrated clearly the need for giving more and more attention to the attitudes and reactions of farmers in all parts of the country. Free and open discussion by farmers and others interested is a vital element in the success of the farm program. With the help of this discussion, and in no other way, can farmers in each county and each important type-of-farming area be prepared to participate more fully and assume more responsibility in the formulation and development of the farm program.

Recognizing that the farm program had to be developed with the help of the farmers at every step, the Agricultural Adjustment Administration has endeavored to develop its practice of two-way planning. Through this policy the opinions of the specialists are discussed and checked with farmers and the opinions of the farmers themselves are obtained for the advice and guidance of the administrators. An endeavor has been made (1) to obtain farmer opinion as to the adjustments needed in each community and each county through the County Planning Project, (2) to promote discussion of underlying philosophy and objectives of the program through the organization of community discussion groups, and (3) to offer farmers the chance to actually formulate and try out through the experimental county approach new ideas or programs which they believe to be better than the regular program.

THE COUNTY PLANNING PROJECT

The County Planning Project was inaugurated in 1935. Its purposes were to establish a procedure for the effective interchange of information and judgments between the farmers and agricultural specialists, and to provide for a larger measure of farmer participation in the formulation and administration of the conservation program. The project is conducted cooperatively through the Extension Service. Under it the farmers from each county were asked to indicate changes in local cropping systems which would be necessary to maintain fertility and control erosion, and to estimate the effects of such adjustments upon the acreages of the several commodities, or groups of commodities, involved.

To accomplish this, county planning committees of 10 to 20 members were organized. The members of these committees were selected by the respective county agents under the general supervision of the State Extension Service, and were chosen to represent the various agricultural communities and interests within the county concerned. For the most part, their membership was made up entirely of farmers, although in some cases, individuals not exclusively engaged in farming were included. As soon as they were organized, these com-

mittees went to work on the task of determining the adjustments needed. Background material was provided through the State Extension Service, and each committee was encouraged to appraise the need for conservation and better farm management within the county, and to study the relation of the production trends and other developments in its county to those of the State and Nation.

For the most part, this work was conducted through meetings. The intensity with which it was carried on varied from county to county and from State to State, depending upon the attitude of the farmers and of the Extension Service staff who were responsible for providing the background material and summarizing the information obtained. In many States, however, the project was developed much more intensively than the original outline called for. In almost all areas where the adjustment problem was acute careful attention was given to the preparation and consideration of all available information before the task of estimating the adjustments which seemed most desirable was undertaken.

When all of the county committees in a State had made their reports, the results were summarized and compared with those obtained in the Regional Adjustment Project. In almost every case where there was a marked difference between the farmer and college recommendations the college specialists felt that their recommendations should be reconsidered and modified. In a considerable number of cases the college specialists were willing to agree directly with the farmer recommendations. Where this was not the case the college specialists were asked to discuss with the county committee the discrepancies and obtain a reasonable agreement between the recommendations developed by the county committee and those arrived at by the State and Federal agencies in the Regional Adjustment Project. The recommendations for similar type-of-farming areas, as between different States, were compared and a considerable number of adjustments made in order to smooth out the differences which were found.

The material obtained from the county committees for each individual county obviously could not be worked immediately into the program. This was both because of differences in standards used by the county planning committees in arriving at their estimates and because of the administrative necessity of a reasonably uniform program in each of the major type-of-farming regions, such as the cotton belt, the corn belt, and wheat areas. But this material was highly valuable in that it indicated those areas in which the acreage goals set by the Agricultural Adjustment Administration were out of line with well informed farm opinion, and provided a basis for making a considerable number of corrections which were much needed. In addition, it served to indicate that for the time being, at least, the farmers believe that the adjustments in acreages of soil-depleting crops which seem to be needed in order to support the agricultural price structure and raise income are also the adjustments which are needed in most counties from the standpoint of soil conservation and good farm management.

Possibilities of expansion.—The general concept of the county planning committee work can easily be widened to include a considerable part of the earlier lines of educational activities relating

to agricultural economics and agricultural reorganization. Thus, the work covered by the agricultural outlook and the farm management and other related State educational activities are all designed to furnish farmers with information and assist them with the interpretation of economic material in terms of changes or adjustments which are needed, both from the standpoint of increasing income and conserving soil. In view of this fact, the county planning committees could well develop into coordinating agencies which would absorb and interpret outlook and other extension material and indicate the direction in which the several agricultural programs within the county could best contribute to agricultural improvement.

At the present time, serious consideration is being given to reworking the County Planning Project into a Department-wide project, with the work of the several county committees coordinated by a State agricultural planning council. Under this concept of the project, the function of the county committees would be to work out the adjustments needed in each community or separate type-of-farming area in the county, and to work with the State agricultural council in coordinating and helping to give local direction to State and Department programs, including the agricultural conservation program.

EXPERIMENTAL COUNTIES

The A. A. A. is also encouraging farmer participation in the planning process through the development of experimental counties. In these experimental counties farmers are given opportunity to work out a conservation program on an experimental basis if it can be expected to throw light on certain problems which have not been solved or which are not being satisfactorily handled under the regular program. The experimental county approach offers farmers the chance to take a larger part in the actual working out of a program which meets the objectives of the Soil Conservation and Domestic Allotment Act and the Agricultural Adjustment Act of 1938, provided such a program does not entail an expenditure of a much greater amount of money than would be involved under the regular program, provided it can be administered at a reasonable cost, and provided it offers promise of achieving the objectives of the Agricultural Adjustment Administration through the use of simpler or more flexible devices than those used in the regular program.

NATIONAL AND LOCAL COOPERATION

The Agricultural Adjustment Administration from time to time seeks to obtain farmer reactions from representative farmers in each county, including farmers on the county planning and agricultural conservation committees. This aid is specially sought when questions relating to changes in the national program for the year ahead are under consideration. As a rule, this contact is made through the State agricultural conservation committee or the State extension service. The farmers of each county are asked for suggestions on specific questions as well as for their general conclusions on what changes are needed in the program which is to be developed for the year ahead.

Important from the standpoint of the broadly democratic objectives of the program has been the encouragement of farmer discussion of the fundamental principles and objectives underlying the national program. In carrying out this work the Agricultural Adjustment Administration has worked with the Extension Service in the development of community discussion groups, which meet regularly to discuss questions relating to agricultural policy or the development of a well-rounded agricultural program. Similarly, the Agricultural Adjustment Administration cooperates with the State Extension Service in holding county-agent schools, at which county agents and, in many cases, representative farmers meet to consider questions of broad social and agricultural interest.

V. PROGRESS TOWARD LOCAL OPERATION

So far, this discussion has dealt chiefly with those aspects of administrative organization and procedure relating to the determination of policy and the formulation of program provisions. But each year the Agricultural Adjustment Administration is also faced with the tremendous task of putting these plans and policies into actual operation. In this work, too, the tendency is toward an increasing decentralization, helping to offset the centralization of responsibility which has been noted in the preceding pages.

This phase of administration is carried out under the supervision of the respective regional divisions in Washington. In developing the plans to be applied in a given year, the provisions relative to their application to the different regions are formulated. In addition, the statistical work involved in breaking down national goals and allotments to regional and State figures and the issuance of regulations for their further breakdown to a county and individual farm basis are handled from Washington. Finally, information regarding the program is prepared and distributed from the central office. A full discussion of this latter function is given in the following section of this chapter.

Operation of the program within the States is handled through the respective State offices. In these offices, goals and allotments are broken down to a county basis and instructions are issued regarding the handling of the program within the counties. Other work of the State office includes supervising and reviewing the work of county offices, and transmitting requests and suggestions to the Washington office.

Except for one region, these offices are in charge of State executive officers appointed by the Secretary of Agriculture upon the recommendation of the regional director. These officers are responsible to the corresponding regional divisions. Functionally, such offices are to be regarded as part of the overhead organization. In their work the State officers are assisted not only by regional representatives of the central organization, but also by State committees which function in an advisory capacity and to varying degrees share in the responsibilities of administering the program within the State.

In the North Central Region the State offices are in charge of the respective State committees. In each instance these committees include a representative from the staff of the State Extension Service.

But the actual work of applying the program to individual farms, including the allocation of goals and allotments, explanation of detailed provisions to farmers and securing their acceptance of the plans offered, checking of performance and similar important steps, is conducted within the counties. The arrangements through which this part of the administrative task is accomplished are of fundamental importance to the whole conduct of the program.

The work of carrying on the program within the county is in charge of the county agricultural conservation committee, with the help in the localities of the community committees of farmers. The county committees are assisted by the county agents, who are frequently elected secretaries of the committees or, if not elected, are ex officio members, and as a rule take a vital part in planning and carrying out the educational work of the programs.

The degree of decentralization in administration which is actually represented by these arrangements depends upon the extent of the responsibility and authority assigned to the county office. Likewise the actual participation of farmers in the conduct of their program is determined by the extent of this decentralization and by the division of responsibility between the county committee and the county agent. In both respects the conduct of the program has varied considerably throughout the country and has changed considerably during the period of operation.

THE WORK OF THE COUNTY OFFICE

In carrying out the A. A. A. programs, responsibilities of great importance have been placed upon the county committees of farmers, often, as has already been stated, functioning with the help of the county agents as secretaries of the committees. The county offices have been the heart of the A. A. A. local administrative and educational system.

When the early commodity programs were launched a tremendous amount of work had to be done in every locality if the programs were to have any chance to operate satisfactorily. Detailed instructions and regulations were issued from Washington, and supervision was supplied by the State office, but many important matters had to be decided locally. It was because of the hard work in the counties, by the county committees and the county agents, that the new programs actually got under way with a hope and a chance of final success.

Particularly in the educational work on the program to secure its acceptance by farmers, including the explanation of detailed provisions, and in the distribution of bases and allotments among individual farms, the county authorities had a considerable field for discretionary action. In fact it seems probable that without this authority in local hands it would have been impossible to put the program into operation. With no precedent and frequently very little factual information available, no one but local people could safely make the decisions required.

Several influences have tended to modify this initial situation in succeeding seasons, giving the county offices more discretionary authority in some respects and less in others. For one thing, as experience accumulated instructions and regulations could be made

more precise and could be written so as to cover more of the conditions to be encountered. Moreover, there was a need for a somewhat greater uniformity in local procedure and this could be obtained most easily through closer administrative supervision from regional and State offices. Still another factor was the tendency for officials to gain assurance with experience and to develop stronger opinions of their own as to how the program should be operated. These and similar influences tended toward a closer supervision of the local office and a corresponding tendency towards centralized administration.

But these tendencies to limit the responsibilities of the county offices were offset by opposite tendencies, which were set in motion by recognition of the significant advantages in having the county office assume a larger and more important place in the program. In all cases the early program had involved a heavy burden upon the counties and in general this was handled effectively and efficiently. Insofar as the nature of continuing activities was discernible at the time it was clear that these activities also would involve many decisions which could best be left to the counties. Moreover, increasing thought and discussion were being given to the problems of long-time adjustment; and, as has already been pointed out, it was already recognized that real progress in this direction must depend upon the direct participation of farmers in the planning and conduct of the program. This would be possible only as the responsibility for such activities remained in the county.

As a result of these opposing influences, administration probably became more decentralized in some respects and more centralized in others. When the program progressed into the more flexible soil conservation phase, the more general inclination was to enlarge the responsibility of the county offices. For example, in making this change it was contemplated that county officials would be given an increasing latitude in adapting allotments to local and individual farm conditions. On the other hand, however, the necessity of effecting a quick change from a production-adjustment to a soil-conservation approach, and the increased attention demanded by legal questions relating to the delegation of administrative authority, introduced further incentives for close supervision from the central office.

THE CHARACTER OF COUNTY ADMINISTRATION

From the standpoint of administrative organization, the central office of the Agricultural Adjustment Administration is linked with the individual farms through the system of regional divisions, State committees and executive offices, county agricultural conservation associations, and county and community committees of farmers. This arrangement is supported by the parallel educational set-up composed of the Federal, State, and county extension service. From the standpoint of actual operation, however, these are more difficult to identify as separate, distinguishable channels. Problems of defining the functions of each and coordinating their operations in relation to the program have been of continuous importance.

When the program was first undertaken it was handled in the field quite largely through the Extension Service. Shortness of time was a major consideration at this stage and the Extension Service already

possessed a complete organization reaching down into the county. Moreover, the Extension Service personnel was admirably fitted by training and experience to assume the immediate task that was faced. Hence, so far as possible, these facilities were utilized in carrying out the program. In a majority of instances, the State extension service assumed practically full responsibility for the conduct of the activities undertaken, although in a number of cases the alternative arrangement of a State committee assisted by the Extension Service was employed. Both of these arrangements placed the county agents, who are part of the extension set-up, in a position of importance in relation to the program.

As the program got under way, greater and greater recognition was given to the importance of utilizing the knowledge and experience of farmers themselves if sound decisions were to be reached on the many immediate problems that arose locally. Moreover, it was felt more and more strongly that in any continuing program, full responsibility for local administration should rest upon elected representatives of the farmers to whom it would apply. Hence the Agricultural Adjustment Administration steadily sought to strengthen the system of county committees of farmers.

The manner in which the functions of the county office were shared as between the farmer committee and the county agent varied within wide limits. Under most of the commodity adjustment programs elected county committees were generally credited with being in charge. The early programs for cotton and some types of tobacco, however, placed responsibility upon the county agent as the administrative representative of the Secretary of Agriculture. Under these early cotton and tobacco programs the farmer committees were appointed by the Agricultural Adjustment Administration upon the recommendation of the county agent and the committees assumed responsibility with respect to basic determinations for individual farms.

In actual practice other factors appear to have had more influence upon the relative status of the committees and county agents than did the regulations established by the central office. One of the most important was the policy adopted by the extension service in the particular State. In some instances this policy was one having the county agent consider himself chiefly as an expert counselor of his committee whom he would encourage to assume the fullest possible measure of responsibility. In such situations the emphasis was placed upon the development of farmer leadership which would run the program, and the committee tended to become the important administrative agency whether it was elected or appointed. In many cases, however, the attitude was held that the control should be retained by the county agent himself.

Probably the most important factor of all was the views of the agents and committee men as to what constituted a proper division of function. Thus some county agents persistently dominated weak committees, whereas others, stronger and more alert to the needs and opportunities for development of farmer leadership, helped to build up strong, able and active committees. Between these extremes many diverse relationships were developed.

As the program has continued more emphasis has been placed upon the importance of the county committees. Under the soil conservation plan more uniform regulations regarding their organization and operation were applied. In particular, provision was made for making all of them elected bodies. The place of these committees in charge of local administration is now definitely recognized in the new 1938 legislation, which also specifies a uniform procedure for their election. Under the new Act, the county agent is ex officio a member of the county committee in all cases. He may also be Secretary of the county committee, but if he is he derives his authority by virtue of his election by the committee and not from his position as county agent.

Although the Agricultural Adjustment Administration has sought consistently to develop the county committees and give them larger responsibilities, it still remains true that as a matter of actual practice there is wide variation in the manner in which responsibilities are shared. In general, the best work is being done in those counties where the committees are in actual charge, but where they are advised by capable and active county agents. In such instances the county agent views his function with respect to the adjustment program as being educational and advisory, with principal emphasis upon the development of farm leadership which has the ability and initiative to accept the responsibility for administering its own program.

The agricultural adjustment programs have achieved a remarkable capacity for developing new leadership among farmers. In the long run, this capacity if wisely fostered should prove to be one of the most valuable of all the attributes of the program. It should be a priceless asset to the farmers of the future.

In the judgment of the Agricultural Adjustment Administration, the associations of farmers in the counties, and the county and community committees representing these associations, constitute the program's greatest instrument for uncovering and developing potentialities for leadership in the farming communities. In a very real sense, the hope of economic democracy for agriculture rests on the farmers' committees. But these committees are most effective toward this end when they have the inspiration and the active help of an able, earnest, and broad-gauged county agent. Both for the successful operation of the current program from year to year, and for the long-time objective of developing capable, local leadership among farmers, it is essential that the program be manned in the county by strong, alert agricultural conservation associations and committees.

As time goes on, more and more States and regions should see that the practical difficulties of establishing vigorous associations and committees can be surmounted. As the difficulties are surmounted, the agricultural industry, the Extension Service, the farm program, and the Nation should share in the benefits of the good work that future years should bring.

VI. THE DEVELOPMENT OF AN INFORMATIONAL POLICY

Problems of the proper handling of public information have deeply concerned the Agricultural Adjustment Administration since it was first created in 1933. Important questions of policy concern-

ing the functions of a governmental information agency in connection with the operations of a national action program are involved.

As it has gone ahead with its work, the Agricultural Adjustment Administration has become more and more convinced that these questions lie very close to the heart of the broader problem of how democracy can make itself more effective in helping the people meet their economic needs.

Because the agricultural adjustment programs have been a new thing in government, the scope and nature of informational activities have not been charted and much pioneering work on the part of the A. A. A. has been necessary. The problems that have been encountered in carrying out the adjustment programs have been given a great deal of thought inside the Agricultural Adjustment Administration and also have aroused considerable outside discussion. The informational activities of the A. A. A. have been seriously criticized on grounds of propaganda, and some critics have gone so far as to maintain that these activities have no value whatever, but on the contrary are incompatible with and dangerous to democracy. Admittedly there are important and unanswered questions covering the extent to which it is right for the Government to go in disseminating informational matter which is of a persuasive nature, which advocates a definite course of action and asks citizens to support that course. Such questions are involved because in a democracy citizens have a fundamental right to oppose, individually or in an organized way, the acts of government, and the institution of a free press is the principal medium through which criticism of government expresses itself. One of the clearest distinctions between the democratic and absolutist forms of government is the existence of freedom of opinion, freedom of utterance, and freedom of the press.

In view of the foregoing, how far can a Federal Government agency go as a matter of wise and sound public policy in publicizing favorably its own activities and in seeking widespread public participation in its programs? How does the dissemination of information by such an agency affect the operations of the democratic system?

Those in the Agricultural Adjustment Administration who have special responsibilities in this field have sought to enlighten the public on this as well as other phases of the activities of the A. A. A.[9]

In this chapter an effort will be made to carry the discussion a good deal further than before on the basis of the experience of the Agricultural Adjustment Administration in this field in the past 4 years. In the discussions which follow, it will be desirable to have in mind a fairly clear definition of the term "propaganda." For the purpose of this report the term is used in its ordinary sense, that is as meaning material which is persuasive or argumentative and which emphasizes one point of view more or less to the neglect or exclusion of other points of view on a subject which is controversial and on which there are different opinions.

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[9] See speech of Alfred D. Stedman, Assistant Administrator, "Informing the Public About the A. A. A.," before the American Political Science Association at Chicago, December 28, 1934. These and other questions concerning the relationship between public, press, and Government were also discussed in lectures by Sir Willmott Lewis, Bruce Bliven, and Dr. Herman Finer in a lecture series on Democracy, and in group discussion with Department executives by J. R. Wiggins, Raymond Clapper, and Turner Catledge, following the lecture by Mr. Bliven.

A good many of those who have criticized the informational activities of the Agricultural Adjustment Administration have in reality been doing so on the broader ground that the entire farm program is unnecessary and inadvisable. This broader question is, of course, a proper one for discussion, but for the purposes of this study, it must be observed that the program resulted from popular insistence that the resources of Government be used to help agriculture meet its pressing economic problems, so as to protect its income and preserve the precious soil resources of the nation. Twice recently the alternative of having no farm program has, after general public debate, been definitely rejected. One instance was during depression when severe economic consequences for the Nation resulted from the effects on industry of farm price declines and losses of farm buying power. The other instance was that of drought occurring in 1934 and 1936, when there seemed to be general agreement that rather than suffer disaster from reliance upon purely individual efforts to combat the drought, the situation called for such a social effort as that represented by the national farm program.

In a nation where more and more people in business, in industry, and in the professions have been deriving the benefits of cooperative effort on an expanding scale, the idea of insisting on a purely individualistic economy for the farmers, and denying them the right to work together in meeting their common problems through a national farm program, apparently has been discarded. A farm program is, in one sense, chiefly organized information about elements in the farmer's problems and an organized way for farmers to meet these problems. The causes of the great economic disasters from which farmers have suffered in the past can now be fairly well ascertained and the disasters avoided if farmers get the information needed and act upon it. The great farm depressions of the past footed the Nation's bill for the high costs of ignorance.

This discussion does not deal with the question of whether or not a national farm program should be carried on. The basis of the discussion is the fact that Congress has by law directed the operation of such a program. Assuming the existence of this program, the questions considered here have to do with the kind of informational effort that should be carried on in connection with it.

INFORMING THE GENERAL PUBLIC

At the outset it must be borne in mind that the informational problem of the A. A. A. consists of two major parts. The first part of the problem is to afford the general public information about the A. A. A. programs. The second part of the problem is to inform the farmers who are participating or who are eligible for participation concerning the agricultural programs which are of direct and special interest to them.

The problem of advising the general public about the adjustment program is a large task in itself, aside from the special and more detailed work of providing farmers with the information they want. The Agricultural Adjustment Administration has the same duty that rests upon any governmental agency to supply information about its activities to all inquirers. It shares with other governmental agencies the responsibility to make a special effort to

furnish information in clear, understandable, and concise form to representatives of informational services of every kind.

There are a great many highly efficient means of distributing information of this type to the general public in the United States. They constitute an immense machine which includes daily newspapers, with their great national press associations and special correspondents in Washington, the radio networks and local stations, the weekly press, the national magazines, the farm magazines and newspapers, the trade press, and special publications and services of various kinds. So far as the general public is concerned, the Agricultural Adjustment Administration has sought primarily, not to create new media for spreading information, but to supply information as well as it could, in the form asked for and desired, to the agencies constituting the immensely valuable machine already existing in this country for dissemination of human intelligence. The Agricultural Adjustment Administration has felt that it has a positive responsibility to do this. In fact, this responsibility rests more heavily upon the A. A. A. than upon some other agencies because of the size and number of its operations, the large amounts of money involved, and the fact that these operations have effects upon all parts of the population. The A. A. A. has felt that failure to meet this responsibility would create serious problems for the Department.

The Agricultural Adjustment Administration therefore includes in its administrative organization a Division of Information equipped with a press service, with writers, editors, and other personnel competent to assemble information and make it available in written and verbal form. The work of assembling information is paralleled in importance by the work of its distribution, and the personnel includes those whose function is to open and keep open the channels of distribution of information. Out of the total of 3,100 employees of the Agricultural Adjustment Administration about 160 are in the Division of Information in all classes of service, including clerical, stenographic, and mechanical workers. Of these, about 30 are engaged in writing or editorial work of various kinds.

Press and radio services.—Through this Division, the Agricultural Adjustment Administration regularly issues to the press prepared releases making public accounts of its principal operations. A special need to make these releases brief, accurate, and to the point results from the greatly increased burden imposed on Washington correspondents of the daily press by the large growth in the number and scope of governmental activities since 1933. The rapid rate of movement of governmental operations designed to meet quickly changing economic conditions has also created a need for promptness in making announcements public. In carrying on these functions, the A. A. A. has operated with the full cooperation and accord of the long-established and efficient fact-finding and fact-disseminating agencies of the Department.

The radio has proved to be an increasingly valuable medium for providing the public with day-to-day information about the operations of the A. A. A. The number of radio sets in the hands of farmers as well as city people has grown by leaps and bounds. The radio is now a tremendously important means of public information and communication, and is becoming more important every day.

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Working with the radio service of the Department, the Agricultural Adjustment Administration has made a special effort to disseminate information to the public through the facilities made available by the radio. In particular, it has broadcast regular reports of its operations to large radio audiences on the Farm and Home Hour. In addition, A. A. A. executives have discussed phases of its programs on special broadcasts arranged for by one or other of the national broadcasting chains at times when public interest in some part of the program was especially alert.

The Agricultural Adjustment Administration has endeavored to follow consistently the practice of affording people accurate information bearing directly upon the questions they ask. The A. A. A. has made it a definite practice to assist newspaper men and other inquirers to go directly to authoritative sources for their information. The informational workers of the A. A. A. have as one of their regular functions the making of appointments for newspaper correspondents with the experts, technicians, and executives whenever these inquirers have wanted to get to original sources and dig out information for themselves. Exceptions to this are instances in which the A. A. A. operating people are so burdened with official duties that they can not grant special interviews, and, of course, instances of requests for information bearing merely on personal controversies. The official press releases of the A. A. A. have not been used as a barrier between reporters and the executives and experts who are authentic sources of information. The reporters have been encouraged to go behind the releases to get their own information from the authorities whenever they wished. The releases have, however, served as authentic announcements. They constitute an accurate official record of administrative acts, with the requisite precision of statement in circumstances where precise statement is necessary. They afford a readily usable form of information for those who do not have time to make independent inquiry. They serve as one minimum commitment that is required of officials even when they are inclined, sometimes with much provocation, to be vague and evasive about developments in the operations in their charge.

The information policy which the Agricultural Adjustment Administration has tried to follow is called an "open" information policy. The A. A. A. has not adhered to this policy without some deviation. There have been occasional departures from it, as for example when the amounts of individual payments, including many large payments, were not made public for reasons which then seemed persuasive. But these lapses have been an exception and on the whole facts have been afforded to all newspapers and publications without regard to whether their editorial and news policies were favorable to or critical of the adjustment programs.

Within the Agricultural Adjustment Administration there has been a keen appreciation by many executives of the special value of alert and independent news reporting. The readiness of the press to report adversities of the A. A. A. and publish critical expressions of the opinions of prominent people about it has been of much more value than reporting of uniform praise would have been. The occasional suggestions made in this country that criticism of government should be suppressed seem to the A. A. A. to overlook not only the right but

also the function of the opposition in a democracy. That function is to stimulate intelligent care and alertness on the part of the administration. Even the kind of opposition most difficult to tolerate, that based on misstatement or misrepresentation of facts, does not justify so drastic a step as censorship or suppression. If the democratic processes are working, even misrepresentation may set in motion its own correctives and create an interest which makes news out of the truth. A. A. A. experience affords some instances of this. For example, in 1934 a story was widely circulated that the A. A. A. was paying thousands of dollars for reducing hog production to farmers who never had raised any hogs. The tale was repeated so frequently and by persons of so much prominence, including a historian and a United States Senator, that it became a sensation. The situation created an opportunity for the A. A. A. to take advantage of the public interest that had been stirred up and explode the story with a simple statement of the facts. This was done and public attention was focused upon the truth to an extent which otherwise might not have been possible. Another example of the same thing occurred recently when a distinguished newspaper columnist in portraying the A. A. A. aerial survey as mere sky spying gave an opportunity for the Administration to call general attention to the true significance of this historic achievement in the first permanent recording in an aerial map of the farm land resources of this country. Thus in a democracy, a mistaken opposition is often harmless because the results inadvertently achieved are just the opposite of those intended.

The Agricultural Adjustment Administration supplies its executives systematically every day with a photostat report reproducing for them the news that principal newspapers of the country are carrying about its operations. This is one way in which the Agricultural Adjustment Administration tries to learn promptly whenever serious difficulties in administration of the program develop in the field. It is also one of the ways by which the A. A. A. learns quickly where misinformation about its programs has become current. Thus the press of the country places before the Agricultural Adjustment Administration every day a swift reflection of public reactions to A. A. A. operations. Using these news reports, and supplementing them with the more detailed information that is necessary from the field, the A. A. A. systematically undertakes to correct mistakes in administration whenever instances are disclosed, and in cases of misapprehension of the facts to supply the accurate information needed to clear up the misunderstanding.

In addition to supplying information to the daily press, the A. A. A. has aided in preparation of special articles for magazines and agricultural and trade organs, and has helped representatives of such publications to get access to the material they have requested.

Research services.—While popular attention has tended naturally to focus on the news of day-to-day operations particularly when they were in controversy, the A. A. A. programs also have attracted the deep and objective interest of many writers, observers, and students of economics and government in this and other countries.

This interest has helped to stimulate the Agricultural Adjustment Administration to exercise particular care in the preparation of its official reports. Such reports have been prepared to cover special

phases of its activities for the information of the Congress and the public. The best example of these is the annual report of the Administrator, of which this is the most recent.

The Agricultural Adjustment Administration has opened its records to scientists and scientific bodies wishing to make special studies of these operations. The best examples of research carried on in this way are the Brookings Institution's published reports on the A. A. A. programs. The Agricultural Adjustment Administration helped the Brookings Institution to make most careful and searching studies of its operations, giving it free access to A. A. A. data, and opportunity for discussion of the latest thinking on A. A. A. problems by executives. The results of these studies have been published in book form.[10] The Brookings research was accompanied by the freest exchange of opinion between the Brookings Institution and A. A. A. officials. Decision was entirely with the Brookings Institution as to how much weight should be given to A. A. A. opinion, and as to which contentions of the A. A. A. should be partly or wholly accepted and which rejected.

In supplying information to public and private research institutions, the A. A. A. has presented its own interpretations along with the facts, but it has also consistently respected the rights of other agencies to reach and publish their independent conclusions. It has been recognized that the varying conclusions reached by outside observers were of greater value than if only the opinions of the A. A. A. were reflected. Many inquiries have been received from, and first hand studies have at times been made by, scientific men in other parts of the world, representatives of foreign governments and research workers from public and private institutions in many different fields of research. Some of these inquiries could not be answered but conscientious efforts have been made to supply information whenever possible.

The A. A. A. has cooperated closely with the scientific bureaus of the Department, with the State agricultural experiment stations, and other research agencies of the State agricultural colleges. Again the Agricultural Adjustment Administration has supplied these Federal and State research agencies, not only with facts but also with its reasoning from and interpretations of the facts. But these explanations have been submitted as part of the proper data for consideration. There never has been any question whatever of the right of any State or Federal research agency to reach its own conclusions and to publish its findings without any regard to whether or not they were favorable to the A. A. A.

Public information and propaganda.—The charge of propaganda is not usually brought with much force against the foregoing information work of the A. A. A. Of course, observers, whether they are representatives of newspapers or of research institutions, understand that it is natural for any agency, public or private, to put its best foot forward in writing or talking about itself. It is not only a natural and human thing to do, but within limits it is also sensible, since the written record of accomplishment affords an important incentive

[10] Seven volumes, by E. G. Nourse, John D. Black, Joseph S. Davis, Harold B. Rowe, D. A. Fitzgerald, H. I. Richards. The most recent, "Three Years of the A. A. A.," by Nourse, Black, and Davis.

to good administration. However, due allowances have to be made for the usual tendency toward self-praise and also for the fact that making public announcements of the A. A. A. meet all the requirements cited in this chapter is an aim but unfortunately not always an actual accomplishment. Nevertheless it is true that within the field of A. A. A. operations, the usual announcements, releases, and reports put out by the A. A. A. are to some extent comparable in objectivity to the announcements of the scientific and administrative bureaus of the Department—the reports of supplies and prices, the estimates of production, reports of marketings, and the announcements of results of research and the recommendations of Federal and State agencies for changes in farm and home practices.

While no doubt press releases tend to be couched in terms shedding favorable light on operations of the agency issuing them, nevertheless efforts are consistently made by the A. A. A. to see to it that they do not omit mention of essential details which have the contrary effect. This frankness is, to be sure, partly due to deliberate judgment that this method involves the least difficulty in the long run. Purely from the standpoint of the day-to-day impression which the public has, the Agricultural Adjustment Administration usually works on the assumption that news about mistakes in operations is least damaging when promptly announced and candidly faced. The A. A. A. opinion is that secretiveness and concealment defeat their purpose and magnify interest in such errors out of proportion to their actual importance. As an example, it is a fact that while the Agricultural Adjustment Administration declined to disclose its largest payments, the clamor about these payments became so loud as to dwarf public interest in other phases of the A. A. A. operations. But once these payments were announced, the clamor ended.

This discussion has now touched upon the general informational activities of the A. A. A. as they relate to supplying information through formal reports and releases to representatives of the public press, periodicals, and research institutions. It has been seen that accusations of propaganda are not very seriously brought against any of these activities. There is, however, another category which is of a more persuasive character than either the press releases or the formal reports, but which like the foregoing are only rarely criticized on the grounds of being propaganda. These are the speeches, letters, and public statements of the executives, including the Secretary of Agriculture when he is discussing the A. A. A. farm program, and the Administrator of the A. A. A.

These speeches and statements are recognized by everyone as being expressions of policy. They contain not only factual material, but also interpretations of the facts, and analyses of national and world-wide situations affecting agriculture. They represent the thinking of the speaker formed by him after consideration of information available to him through the operations of the entire A. A. A. While made by a single executive, they represent in part the composite judgment of the A. A. A. They contain personal and official philosophy, argument, defense, and also at times, viewpoints attacking or disputing the reasoning or citations of facts by critics.

Nevertheless while they are clearly persuasive, that is almost never taken as grounds for criticism of these expressions of policy. It is

considered to be wise and useful that all of the various elements that go to shape important public policies should be discussed in their relationships to each other. About the only way this can be done is in a speech or a letter or a radio utterance. These speeches and statements make no pretense of being mere announcements of objective and unrelated facts. They usually represent an effort to give a connected description of the main facts and a reasoned interpretation of the conditions which have led the Government to operate as it is operating. Such statements are in the nature of an accounting by the executives of the Administration to the general public and to the farmers to whom these executives are responsible. They frequently constitute the most enlightening expressions about the program that are available to the public. Occasionally they prove to have pronounced effects upon the development of the farm program. It may be that in the future some of them may come to be regarded as having made lasting contributions to the history of agriculture.

INFORMING THE FARMERS

The second main phase of the informational problem of the A. A. A. has to do with informing farmers about the A. A. A. farm programs, and with encouraging them to participate in these programs. In respect to both the adjustment and marketing agreement programs, this work supplements the administrative process in a way so important that without it the programs could not operate. The process of getting information on marketing agreements into the hands of farmers is still new, has large opportunities for improvement, and is being improved steadily. As to the adjustment programs, the methods are longer established and better understood, and the A. A. A. county and community committees play a vital part in them. These committeemen perform a service of communication to agriculture that is unique and invaluable. When a new program is being launched, the committeemen talk it over in regional conferences with State committeemen, extension workers, and representatives of the A. A. A. The county and community committeemen then carry this information to the farmers themselves in local meetings all over the country. Printed bulletins, pamphlets and leaflets, some of a popular and some of a technical nature, are used but primarily the educational process is carried out through personal discussion in the meetings, and the printed materials are of value principally in providing the basis of these discussions and supplying references for use in them.

Cooperation with the extension services.—In general, the work of informing farmers about current programs is the field in which A. A. A. methods are sometimes referred to as involving the use of "propaganda." It is therefore the field in which the problem arises of the extent to which in a democracy these methods are proper and wise. Before launching into a discussion of this problem, however, it is essential to recognize that an important distinction exists between two types of informational effort. One type is that with which the A. A. A. is primarily concerned each year in operating the current farm program, in informing farmers about that program, and in encouraging their participation in it. The other is the long-time, fundamental educational work which is carried on by Government

agencies among farmers, and which seeks to increase their general knowledge of the sciences of plant and animal production and of basic economic conditions which affect agriculture.

This latter type of broad educational activity among farmers has been carried on for many years by the established bureaus of the Department, by the State colleges of agriculture, and the Extension Service.

Naturally a development in agricultural policy so important as the appearance of the adjustment programs has had marked effects upon this long-time educational work. Temporarily, at different times in different States or regions, the adjustment programs have disturbed long existing State and Federal relations in the field of education. But with experience and better understanding of the nature of the new problems, these difficulties have been surmounted.

Carrying on the fundamental educational work of the Department of Agriculture has been and continues to be a function of the Extension Service, cooperating with the extension services of the several States. It is true that some general educational activities have been carried on by the A. A. A. The A. A. A. has and will continue to have a deep interest in these activities; and, although the field is recognized as being chiefly that of the Extension Service, the A. A. A. does what it can to assist and supplement it.

The A. A. A. programs have had marked effects upon the basic educational work of the Extension Service. They have increased enormously the need for and interest in fundamental education in the economics of agriculture and industry, the sciences of production, farm management, and soils, the relationships between producer and consumer welfare, etc. The A. A. A. programs have given a tremendous and healthy stimulus to all the work of the Department in this broad field. The programs have afforded farmers a systematic means of putting to immediate and practical use the knowledge of good farming methods and of economic problems which, over the years, the educational efforts of the State and Federal extension services have been steadily making available to them. This basic educational work of the extension services is useful to farmers whether they take part in the A. A. A. programs or not.

The A. A. A. has, however, had other effects on the work of extension. For a time, in a good many States, the Agricultural Adjustment Administration had to rely largely on State extension services for actual administration of the program in the State. This naturally tended to alter the principal function of extension, and to cause personnel and resources greatly needed for basic educational work to be focused upon administrative duties. This situation in the States has, however, been relieved as the State and county committees of farmers have been able more and more to assume the burdens of local administration.

The Extension Service has also been affected in another way, as the A. A. A. has sought for its cooperation in the field of the other type of information—that is, the work of informing farmers about the current program and of encouraging their participation. The State extension services, with their county agents in every county—many of them chosen by farmers to serve as secretaries of the county A. A. A. associations—have been of great help in this field. However, the

director of the State extension service is primarily responsible to the State college and not to the Secretary of Agriculture, and as a State agency the State extension service determines for itself the extent to which it will or will not carry on this type of informational work on current A. A. A. programs. In carrying on this essential process of communication with farmers about the current program and encouraging them to take part in it, the practice of the A. A. A. is to welcome the fullest cooperation from the State colleges and extension services that is possible, recognizing frankly, however, that any State has the unquestionable prerogative of leaving part or all of this kind of informational activity to the farmers' committees and the A. A. A. administrative personnel. Although the work of informing farmers about current programs has been improved considerably, one of the greatest problems still confronting the A. A. A. is that of supplying correct information about and understanding of the programs among the millions of farmers in the United States. The A. A. A. needs to improve a great deal its educational work on current programs and greatly needs all the help the Extension Service can give. One thing which can be done by the A. A. A. is to give better service in the States and provide more cooperation with State extension services. The A. A. A. State offices can take steps to assure that more adequate information regularly reaches the county and community committeemen and the farmers. It is essential to administration of the program that the A. A. A. committeemen be promptly and effectively supplied with adequate information about the program.

Farmer information and propaganda.—With the distinction clear between basic educational work of the State and Federal agricultural agencies, and the current informational work of A. A. A. in its annual programs, a discussion of this latter kind of effort, to which the term "propaganda" has sometimes been applied, can be undertaken.

The operation of A. A. A. programs depends on the individual decisions of large numbers of farmers. Obviously the decision of individual producers determines whether they will participate in the program or remain outside. The way in which each individual makes up his mind depends, at least in part, upon the adequacy of his information about the program and about the way in which it will affect him. In order to be in a position to choose intelligently a farmer needs to know the facts about the program as it applies to his farm. And he has an unquestionable right to be given these facts. This right was recognized, especially by Congress, very early in the life of the A. A. A. This specific recognition of the right of farmers to have adequate information was given by amending the National Industrial Recovery Act in 1933 to include the following:

> Notwithstanding any provisions of existing laws, the Secretary of Agriculture may, in the administration of the Agricultural Adjustment Act, make public such information as he deems necessary in order to effectuate the purpose of such act.

The administrators of the adjustment programs have a clear duty to supply the essential information regarding their operations so far as they can do so. This responsibility of the A. A. A. extends to farmers who do not participate as well as to participants. The ad-

ministrators would be failing in that duty if they neglected to supply the farmers with this information.

THE BACKGROUND OF UNBIASED INQUIRY

Information about the current A. A. A. programs goes through two distinct phases. During the first phase, the attitude of the A. A. A. is one of inquiry, and is therefore relatively objective and unbiased. In the second phase, however, the A. A. A. is not neutral but engages in positive support of a program. The first phase is the period of program making, and the second is the period of program operation. The work of the A. A. A. in providing farmers with information about the program as a basis for their decision on the question of participation begins when the program-making phase is ended.

In the first phase, the Agricultural Adjustment Administration gathers all the essential information that it can get from the several important sources that are available. One source is the farmers themselves. Their recommendations as to the kind of program they want are worked out through the county planning committees and are considered along with other data. The A. A. A. seeks to make sure that its new program is well grounded on the facts. Therefore a large part of program planning consists in gathering the necessary data. These data are assembled from research agencies of the Department and of the State colleges of agriculture and agricultural experiment stations. The A. A. A. relies heavily upon the Bureau of Agricultural Economics to provide the pertinent facts about supplies, plantings, prospective yields, and the outlook for new markets here and abroad. The A. A. A. also, in this fact-finding period of program making, draws upon the expert knowledge of the Soil Conservation Service, the Bureaus of Plant and Animal Industry, the Bureau of Chemistry and Soils, and the other bureaus to afford advice as to the extent of soil destruction and as to up-to-date methods of protecting soil against wind and water erosion. It draws likewise upon the information in possession of the scientific bureaus as to regional and local adaptabilities, opportunities for improvements in farm management, and chances to develop the farming industry in such a way as to meet the health needs and dietary requirements of all the people. This work of the established research agencies in obtaining this information is purely scientific and objective, and the Agricultural Adjustment Administration endeavors, in collating the facts and formulating them into a program, to exercise scientific deliberation and discrimination of judgment.

Building a program requires careful analysis by technicians of the data that have been assembled from all sources. It requires reasoning from the facts. It requires the exercise of forethought as to future developments. It requires accommodation of the national program to the needs of different localities and regions. While a program is in the formative stage, there is a great deal of discussion pro and con of the proposed provisions. Many provisions are modified or rejected entirely after weaknesses are revealed by such debate. This is the period of free exchange of opinion within the A. A. A., of weighing of advantages against disadvantages, of doubt and decision.

THE ELEMENTS OF PERSUASION

When the program has finally been worked out and agreed upon, the Agricultural Adjustment Administration then must face the fact that the success of it depends very largely upon the degree to which farmers accept it and participate in it. By the time the program is completed, it presents the best composite judgment of the A. A. A. as to what a program worked out within the terms of the law should contain in order to serve most effectively the interests of the farmers and the general welfare.

Having reached such a judgment, the A. A. A. is impelled by various factors to present the program fully and effectively to the farmers, and in so doing to place emphasis upon its advantages to them. For one thing, the A. A. A. would not be honest or candid to pretend to have a neutral attitude toward its own program. Moreover, the A. A. A. knows that no matter how good a program is it will be relatively useless unless large numbers of farmers understand what the program is and take part in it. Furthermore, each new program has usually been subjected immediately to sharp attack, sometimes led by forces having a selfish financial interest in causing it to fail. In fact, the programs that the farmers have carried on through the A. A. A. have for 5 years withstood almost continuous assaults, constituting an opposition campaign having few parallels in the history of this country. These attacks have at times involved serious and systematic misrepresentation of facts, resulting in demands from farmers and others for accurate information.

So this phase of the A. A. A. program work is the phase of communicating to farmers information about the program—of telling "the what, the why, and the how" of that program. To be more specific, this means explaining to farmers what the main provisions of the program are, why they are needed, and how farmers may carry them out on their own farms. The acquainting of farmers with the nature of the program is carried on, as has been said, largely through the State, county, and community committees of farmers which administer the program. Informing the county and community committees about the program is a vital step in the whole process and it is essential that channels of information to these committees be kept open. The work of informing the committees paves the way for the program discussion meetings that are held later with the farmers generally in each community. These meetings cannot be successful unless the committeemen first are adequately informed. The written and spoken statements distributed to A. A. A. committeemen and farmers are such as to arouse a favorable response on the part of farmers and encourage them to take part in the plan. Under a definition of "propaganda" as broad as that given at the beginning of this chapter, published matter distributed to farmers describing the programs would, in some instances at least, be considered to fall within the meaning of that term, even though the information scrupulously undertakes not to misrepresent any facts to anyone. It is propaganda in the sense that the A. A. A., with full respect for the facts, still gives the farmers an extensive presentation of one course of action as being more desirable than others. The process involves picking and choosing as between sets of facts, placing more emphasis upon some than upon others according to a judg-

ment of their relative importance. Thus it does involve a departure from the objective attitude. It involves active support of a positive plan of cooperative action which is intended to improve the economic condition of agriculture.

EFFECTIVE METHODS OF INFORMATION

The task of informing millions of farmers and the general public about the agricultural program naturally involves tremendous practical problems and there are differences of opinion among people in Government about the relative effectiveness of alternative methods.

In place of a detailed discussion of method, which does not seem necessary here, the opinion of those responsible for informational policy during the period covered by this report is briefly summarized. This opinion is based upon 5½ years' experience of the A. A. A. in the field of information, and points to the conclusions which follow:

1. Successful education of great numbers of people about a complex operation requires the use of the simplest, most direct and clearest methods that can be devised. The reason for this is not the limitation of human understanding so much as the variety and intensity of the other things that always are competing with the farm problem for the interest and attention of laymen.

2. As the audience narrows from the general public or the general body of producers to a smaller number of persons, such as administrative personnel, who have greater interest in detail, more use can be made of the lengthier and more technical types of bulletin materials.

3. The importance of the problem of distributing information cannot be overemphasized. The press, the radio, the magazines, the news reels, and other media are disseminating more and more information to the public and the Government should not hinder but help them in the more effective performance of their function. In carrying out a farm program, channels of communication have to be established by the administrative agency, in order that clear and accurate information about the program can be distributed promptly to administrative personnel and participating farmers in every locality. Having such an efficient distribution system is vital to the farm program.

To flood the rank and file of farmers or community committeemen with voluminous technical publications creates confusion and defeats the purpose of the educational effort.

To achieve real and lasting understanding by large numbers of people and so to make a genuine contribution to the growth in this country of intellectual democracy, educational material must be prepared with the greatest care so as to be given the clearest possible form. When possible, it should be made graphic. In written material, this can be done by the use of short sentences, and simple words of clear meaning. The printed word can be supplemented by the use of pictures and sound. This does not mean that money should be squandered on luxurious publications. The Government has to be economical in its expenditures for information materials. But to issue printed matter which in wording is so abstruse or in style and format is so unattractive that it will be read by only a small minority of those

to whom it is sent is a waste of funds. The most economical printing is that which at least cost is actually read and understood by the greatest number of those for whose use it is prepared.

As democracy grows, and its cultural as well as its economic foundations are better understood and more appreciated, great strides undoubtedly will be made in education. A vast educational process is going on all the time, and to this process each of the great media for transmitting human intelligence makes its contribution. Some of the elements of the problem are fairly well recognized. It is generally understood that the qualities of the human mind vary greatly from one person to another. Some people get their clearest mental impressions as word symbols through the eye. Some assimilate ideas much more rapidly when the ideas are transmitted through the eye in the form of pictures rather than words. Some seem to get more quickly the ideas reaching them through the ear—as when a radio speech conveys impressions through the sense of hearing. But nearly all of us can grasp quickly and retain a simple idea conveyed by graphic visual media, i. e., by the direct speech of a speaker who is visible, by short clear sentences displayed in type big enough to be easily read, by pictures supplemented by a few direct explanatory words conveyed to the eye in printing or to the ear in sound. Vivid impressions are given by such combinations as sound movies, exhibits, and sound film strips. The tremendous success recently scored in the picture news magazine field is proof that simple graphic methods, with brief use of the printed word in cut lines, are appealing to the average man, and effective with him.

The experience of the A. A. A. in educational work seems to point to the greater use of brief one-, two-, or four-page leaflets, of brief, illustrated material, of more compact releases to the press, of posters and of exhibits appealing to both eye and ear for use at fairs, of film strips and sound pictures, and of the radio. The experience of the A. A. A. shows the importance of having competent editors and writers who know the language of the average man, who can think straight, and who are able to reduce complex and technical material to simple form that laymen can quickly understand. For whether an idea is to be presented in a poster, a sound movie, a radio talk, or a leaflet, it will have greatest value and effectiveness only if it can be expressed clearly in word form because people most commonly exchange their thoughts in words. The effectiveness of the farm program itself depends to a large degree upon the clarity of the thinking and adaptability to clear statemenet of the reasoning upon which the program is based. Farmer participation in the program will be considerably measured by the reasonableness of the program, how well the rank and file of farmers understand it, and how much it appeals to their common sense.

In connection with all the foregoing it should be borne in mind that the great educational gains made by the A. A. A. in spreading knowledge of farm problems among farmers have come primarily from discussion of these problems by the farmers themselves in their own meetings with their own committeemen and other leaders. The methods here described have been most useful in providing the material that serves as a basis for these discussion meetings. But great opportunities exist for increasing understanding of agricultural

problems both by farmers and the general public through improved use of these methods.

THE FUNCTION OF INFORMATION IN A DEMOCRACY

It is hoped that the nature of the information problem in the actual operation of an action program in a democracy has become fairly apparent from the foregoing discussion. The question is: Can such informational efforts be carried on constructively in our country or are they in some way inimical to democracy? Does the action program, and the use of persuasive informational methods in carrying it out involve danger to freedom of the press and free speech? Such a danger would mean that democracy itself was endangered.

But democracy itself—the majority of the people—has insisted that the Government take action to help the people meet their pressing problems. The people have shown that they will not tolerate inaction on the part of the Government when distress could readily be relieved by cooperative programs carried on with Government help. In fact, democracy seemed most in danger when Government refused to take action to meet these problems. When it did act positively, the danger to democracy seemed to recede.

When action programs are demanded of the Government, it becomes essential to inform the people about these programs. Informed public opinion is the basis of democracy. Adequate information is all that stands between democracy and the complete inefficiency and ineffectiveness which hithereto have paralyzed the people during a depression. The effort to inform 6,000,000 farmers about the outstanding facts of their economic problems, and to give them and the general public an understanding of these problems and of the program that has been worked out to meet them is, perhaps, one of the largest and most difficult educational undertakings in the history of democracy. To be most useful, this informational undertaking must be tied to a program which is itself in the public interest. The educational effort must be truthful and factual in character and not a mere campaigning of ballyhoo and bunkum. It must not be high pressure promotion. It must not depend on the shallow and artful tricks of publicity. It must not rely on stirring dangerous fires of fear or hate. A national farm program must have too deep and enduring usefulness to the Nation to be achieved by the trickery that peddles cheap nothings to unwilling customers, or that merely wins petty political triumphs which while seemingly brilliant one day are gone the next, or that furthers the sinister ends of powerful and selfish interests. The purposes of government must be firmly grounded in the lasting welfare of all the people, and the methods used should have worth and integrity great enough to match these ends.

DEMOCRATIC SAFEGUARDS AGAINST PROPAGANDA

A program such as that of the A. A. A. must contain in itself adequate safeguards against violations of these ends. First of all, the program must meet one vital qualification: It must serve the interests of the general public as well as the farm group.

As an assurance that the program is in the national interest as well as the interest of the farm group, the authority for operation of the program rests upon the approval by the national legislature representing all shades of public opinion and all groups of the people.

A second assurance is the readiness of administrators on their part to require that the program shall be of such a nature as to serve the national welfare as well as the farmers as a group. This responsibility of the farm program to the whole people has been recognized over and over again by the Secretary of Agriculture and by the administrators of the Agricultural Adjustment Administration. One of their principal tasks, therefore, from the point of view of both economic and political science, and one of the principal concerns of those especially interested in the A. A. A.'s public relations problems, has been to seek out the points where the interests of the farmers coincide with the interests of the general public and to build the program upon these key points as a foundation.

A further safeguard to democracy in carrying out an action program is that the program itself shall be of a democratic nature. The A. A. A. adjustment program is carried on by nearly 4,000,000 farmers and the A. A. A. marketing agreements on their part affect possibly 1,500,000. In respect to operation of marketing agreements, the farmers through special committees have a large voice, and the farmers have a large part in running the adjustment program through the county and community committees of farmers, which they themselves elect. This is a democratic form of organization comparable in some degree to the old town meeting method of discussing and deciding public questions. The farmers themselves are as a group very independent in spirit and action. The picture of them so often painted by opponents of the farm program as being submissive persons looking for somebody to tell them what to think and do is a fiction. The farmers are not that kind of people. They do not take orders from anybody. But even if they were not independent minded and there were a real danger of "regimentation," the committee form of farmer organization would be a strong protection of democracy. Further protection of the same kind is the requirement that when an emergency program includes close controls or regimentation, the methods must be conditioned upon a favorable vote of a large majority (two-thirds majority) of those farmers voting in a referendum.

Still another safeguard is the existence of strict regulations to assure that the programs are carried out on a nonpartisan and nonpolitical basis. This means that all payments to farmers must be made in a fair, impartial, and impersonal way and on an absolutely nonpartisan basis, that no payment under any circumstances can be made to any individual on any grounds of political influence or identification with party or party leadership.

It is required also that the farmers' committees must be prohibited from official participation in political campaigns. This is the reason why the articles of association of the farmers' county associations contain the following among their regulations:

> The tenure of office of any committeeman, delegate, officer, or employee shall be automatically terminated and a vacancy shall exist when such person becomes such a candidate or accepts such a political position.

The office, clerical, mailing, or other facilities of the association shall not be used for political purposes, nor shall any such facility be used in any way to support, assist, or oppose any political candidate or party or for any other purpose than these set forth in article II.

Most vital of all, however, is the requirement that the action programs do not interfere in the slightest degree with freedom of speech, freedom of the press, and freedom of assembly. Opponents of the program must be free to criticize; they must have the liberty to present organized opposition. They must have the freedom to find fault with the Government's operations and to express their opposition. They must have access to the radio, to the press, and to the public forums. The requirement is that nongovernmental agencies as well as Government shall have opportunity to express themselves to the people.

If these key institutions of democracy continue to function, if the Government does not try to undermine them, but cherishes their value and strives to build them stronger, then it appears that democracy is not endangered by a program of action, even if that program is carried out in part through the dissemination of information which is of a persuasive nature.

It is too much to expect all the rules of democracy to be adhered to at all times without any mistakes or failures. But nothing is more certain than that democracy has effective ways of punishment for grave and persistent infractions, just as it has effective rewards for important service well done. The degree to which the rules are observed is the best measurement of good administration.

Democracy depends more than any other system of society upon the information and intelligence of the people. The reason for the existence of an action program such as the A. A. A. is to help the people make democracy work. The purpose of the informational activities that have been described in the foregoing pages is to supply farmers and non-farmers with information about the program, the reasons for it, and the details of its operations. When these informational activities are examined in the light of the facts and the human needs of the people, they seem to have a legitimate and vital place in democracy.

VII. WHAT THE EXPERIENCE HAS SHOWN

The progress of the experiment in administrative organization and procedure which the Agricultural Adjustment Administration represents cannot be stated precisely and positively. Certainly it is not yet possible to measure precisely the results obtained. But the experience of more than 5 years has revealed something of the value and limitations of the arrangements which have been described.

At the beginning of this discussion it was pointed out that the Agricultural Adjustment Administration should be judged from two distinct points of view: First, as an action agency charged with carrying out the provisions of legislation designed to benefit farmers immediately; and second, as a planning agency charged with merging the immediate adjustments into the long-time trends of permanent agricultural policy. Both of these viewpoints have influenced the administration of the program and should be taken into account in any conclusions drawn from the experience so far obtained.

PROGRESS TOWARD THE IMMEDIATE GOALS

From the first point of view it is believed that the Agricultural Adjustment Administration has attained a very considerable measure of success. The A. A. A. feels that as an action agency it has as a rule been responsible, and reasonably efficient and effective, considering the difficult nature of its task and the critical circumstances under which it has operated.

For the most part the Agricultural Adjustment Administration has attained whatever degree of success has been achieved in fulfilling its obligation to carry out an action program for the immediate benefit of agriculture by exercising directly the authority with which it has been endowed by Congress. To this extent it has functioned as a centralized agency. At the same time, important features of self-regulation by the agricultural industry itself have been retained and these have obtained for the program many of the advantages inherent in democratic administration. In part this has been accomplished by proceeding upon the basis of recommendations from farmers and by bringing administration into the closest possible contact with the farmers themselves. But in part also it has been accomplished through the development of special methods for consulting the views of the farmers on administrative matters. Through the use of these methods the Agricultural Adjustment Administration has obtained the benefit of farmer experience in determining policies and formulating the programs.

Likewise, features of democratic administration have been obtained by partially decentralizing the task of carrying out the program and leaning heavily upon the judgment of farmer committees in applying the program to local and individual farm conditions. All of these features appear to have been indispensable to the successful conduct of the program under the conditions which have prevailed. They have been particularly helpful in working out plans which would benefit the maximum number of farmers and probably have furnished the only possible means of arriving at an equitable allotment of these benefits within the counties.

PROGRESS TOWARD THE LONG-TIME OBJECTIVES

These same features of the program evidence progress in the direction of the long-time objective with respect to administration. It seems to the administrators that, on the whole, this progress also has been encouragingly large; probably as large as could be expected in view of all the circumstances, including the somewhat conflicting requirements arising out of short-time or emergency situations. But the accomplishment from this point of view has not been so complete or conclusive as it has been from the standpoint of satisfying immediate requirements. The arrangements which have been described still fall short of the goal of establishing agricultural planning by the farmers themselves—effectively assisted by the Department of Agriculture, State agricultural colleges, and other agencies—as a recognized and permanent institution. A great deal remains to be accomplished if this objective is to be fully attained.

Several factors have operated to limit the extent to which the democratic process could be developed in administering the program

thus far. One of these has been the shortness of the time within which the provisions of the program have had to be developed in each year. The original adjustment legislation was approved on May 12, 1933. Likewise the laws authorizing the soil-conservation program of 1936 and the adjustment program of 1938 were approved late in February of these years. Hence, in three instances provisions of a new program have had to be formulated under pressure of time.

Moreover, the operations were disrupted in 1934 and again in 1936 by drought conditions which made it impossible to consider plans for the succeeding seasons on anything like a normal basis. Therefore, in practically every year policies have had to be established and plans formulated and put into operation under conditions which, from an administrative standpoint, closely approached those of a continuous emergency.

Under these circumstances it has seemed impossible to develop the full measure of farmer participation in determining adjustment policies and formulating programs that is contemplated as being most desirable from a long-time point of view. Arrangements for such a conduct of the program must be developed slowly. Moreover, even if these arrangements could be suddenly established it would not be reasonable to assume that the farmers themselves could take on themselves all at once the manifold responsibilities involved. The experience so far indicates that farmers are fully capable of assuming the duties and responsibilities contemplated by this conception of the long-time program, but that much work is required before these potentialities can be fully utilized.

At the present time, few question the fundamental importance of retaining the principle of democratic administration in a long-time farm program, but there are different views even within the Agricultural Adjustment Administration as to the extent of the responsibility which should be assigned to farmers. These differences are evident from specific proposals that are made, from appraisals of various administration features, and from the various adaptations of the administrative structure in various regions. They arise out of variations in individual concepts of the function of the administrative agency, out of differing views as to responsibilities which may be assumed by farmers, and out of differences in opinion as to the purposes of the program and the relative emphasis to be given immediate goals as compared with long-time objectives.

In general, administrators agree that the program could be administered with greater speed and probably more economically if a democratic procedure were not employed. Payment to farmers for part-time committee work is in some respects less expensive than hiring full-time Government employees, but there is also considerable loss in training new committeemen, and the efficiency of the latter can hardly be expected to be as high as in the case of permanent employees.

But even though centralized administration may be more efficient and less expensive, it is believed that any method of centrally framing rules and regulations to be applied locally must encounter a fundamental difficulty when it is employed in a continuing program. In the last analysis, effective administration can proceed only as

fast as comprehension and understanding by the farmer. Bureaucratic machinery breaks down sooner or later when it must struggle against an uninformed or unsympathetic public. Moreover, it tends to follow precedent, and hence to become fixed in some conventional pattern rather than to maintain a progressive development. The democratic procedure develops understanding fastest, and in thus strengthening the weakest link it effectively strengthens the whole undertaking.

Finally, in comparing bureaucratic and democratic procedures for the conduct of agricultural programs in behalf of the general welfare, it is evident that in cases where farmers themselves make the decisions, they are more interested than before in actually conserving soil fertility and actually contributing to the permanent value of their land. Thus, through such methods the Nation is likely to gain both in better farmers and in better citizens. On the other hand, if the program is bureaucratically administered, it faces grave danger of becoming primarily a means of payment distribution—with the farmer's chief concern that of securing the largest possible allotment of funds.

The conclusion stands out that the best kind of farm program, and the one most suited to function in our country, is one in which the farmers themselves have a large voice. The courts being willing, the farmers could play a bigger part than they have, with benefit to themselves, to the program, and to the Nation.

CHAPTER 9

CONCLUSION

An earnest attempt has been made in this report to afford the Secretary of Agriculture, Members of Congress, and the general public a factual and analytical account of the work of the Agricultural Adjustment Administration.

While it covers primarily the period from January 1, 1937, to June 30, 1938, the report has also gone back into the history of the earlier adjustment programs. In its analytical portions, the report has tried seriously to achieve an objective attitude, because this approach seemed to have the greatest possibilities of value to the public, the Department, and the Congress. But while apart from their context, these portions might be interpreted to mean that the tangible accomplishments, as measured by the statistical method, were not large, still the general effect of the report as a whole is to bring out the great worth of a truly pioneering effort in the development of a national farm program.

I. THE PROGRAMS AS AN AID TO RECOVERY

The Agricultural Adjustment Administration programs were established as part of the Federal Government's broad program for national recovery. Their purpose was to wage war, on the farm front, against the Nation-wide depression. Others might debate the wisdom of having any farm program, or deliberate exhaustively over the exact amount of the results obtained by it, but the Agricultural Adjustment Administration had a clear mandate for action.

The Agricultural Adjustment Administration did what it had to do. When the A. A. A. was created in 1933, the Nation had been swept into the vortex of a depression. While now some may contend that the economic situation of the country would have straightened out without the help of Government, then the Nation did not want to take such a chance any longer. The people at the polls had emphatically rejected the policy of governmental inaction. One of the consequences of that decision by the electorate was the enactment by Congress of the Agricultural Adjustment Act of 1933.

The A. A. A. accepted the responsibility for administering the law, and the related laws that were later enacted. Back of this legal responsibility, it had the duty of helping American agriculture to make adjustments which could not be further neglected except at the greatest peril. These adjustments had been made inevitable by the shrinkage of world markets for American export products as a result of our transition from a debtor to a creditor nation following the war. The adjustment to fit smaller markets could have been

accomplished through starving out large numbers of producers, but after business and industry had shared with agriculture the acute pains of that process, the plan of Government help in making the adjustments was adopted as a safer and better way. The development of a program to enable the farmers to work together cooperatively in meeting their production and marketing problems was also necessitated by the increasing use of controls of supplies and prices by corporate industry in the United States.

So the task of the Agricultural Adjustment Administration was to help farmers meet problems which had to be met.

Next to the crisis of the depression, the droughts of 1934 and of 1936 confronted the farmers' programs with tremendous work which had to be done. The farmers had learned that working together in a national program, they had a common defense against either drought or depression, while as individuals they had been easy victims of both. Having come through the dangers of drought and depression, the farmers needed to maintain farm income on an even keel. The reality of this task and the usefulness of the farm program in accomplishing it were shown as a new depression began to threaten late in 1937.

II. THE PROGRAMS AS AN AID TO AGRICULTURAL CONSERVATION AND STABILITY

With passage of the Soil Conservation and Domestic Allotment Act in 1936, to take the place of invalidated parts of the Agricultural Adjustment Act, conservation of the fertility of the Nation's farm lands became one of the responsibilities which the farm program had to face. Besides being a legal requirement, this was a responsibility to the general welfare. If anything lies within the proper scope of Government, it would seem to be the conservation of the national resources upon which the existence of human life depends. Yet no lesson of economic history stands out more clearly than that the absence of Government protection of these resources, leaving the handling of them to the forces of unlimited competition, has led to the ruthless exploitation and destruction of the land, forest, animal, and mineral resources of the country. For generations, farmers have been driven by recurrent collapse of their incomes into the sale at bankrupt prices of their soil fertility. They have had to mine their soil because they could not afford the small immediate cost of conserving it. The result has been immense losses to the farmers and the consumers of the present and future. The Agricultural Adjustment Administration undertook the urgent task of devising a national program through which farmers could substitute cooperative conservation for competitive destruction of soil fertility. Such a program is in the interests of the lasting welfare of the Nation.

The farm programs have had one further responsibility, which grew out of the great droughts of 1934 and 1936 and out of the tremendous surpluses of farm products which preceded and followed those short-crop years. This is a responsibility not only to farmers but to consumers. It is the need to stabilize farm supplies in order that farm prices and consumer prices may be more stable. It is the

need to find better ways of using the surpluses of the big-crop years to offset the shortages of years of crop failure. Meeting this responsibility is the purpose of the Ever-Normal-Granary plan which the new farm act now has provided for the protection of farmers and consumers.

* * * * * * *

So the story of the adjustment programs is best told by the kind and the scope of the work they had to do. The work is not finished, and perhaps is only begun, but the launching of a great social effort is in itself a significant event in the history of such an effort.

This report is of necessity written in impersonal terms. But the achievements of the adjustment programs are, in fact, not impersonal. They are the result of the combined efforts of several million farmers to carry on the program, and of a vast amount of work in every farming community and every State of the committees representing the farmers. These achievements are also the product of years of tireless and devoted effort by the remarkable body of men who have staffed the A. A. A. in Washington and in the field.

During all 5 years of the existence of the Agricultural Adjustment Administration, the farm programs have been under ceaseless attack by powerful and organized forces of opposition. But because so many people have felt that the need for the program is real, it has emerged from all these assaults stronger and better than before, continuing to serve the interests of agriculture and of the entire Nation.

APPENDIXES

Appendix A.—SOIL-BUILDING PRACTICES APPROVED AS MEANS OF OBTAINING CLASS II OR SOIL-BUILDING PAYMENTS, WITH RATES OF PAYMENT AND LOCALITIES WHERE APPROVED

Exhibit 1.—APPROVED SOIL-BUILDING PRACTICES, RATES OF PAYMENT EARNED BY FOLLOWING SUCH PRACTICES, AND LOCALITIES FOR WHICH PRACTICES WERE APPROVED UNDER THE 1937 AGRICULTURAL CONSERVATION PROGRAM

Practice	Rate of payment	Area in which practice is applicable
A. General farm practices:		
(1) Seeding adapted perennial legumes.	$1 to $4 per acre [1]	All States except Maine and Vermont.
(2) Seeding adapted biennial legumes.	$1 to $3 per acre [2]	All States.
(3) Seeding annual legumes (except soybeans, cowpeas, and other summer legumes).	$1 to $2 per acre	Do.
(4) Seeding perennial grasses and grass and legume mixtures.	$1 to $3.50 per acre	All States except Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, and New Jersey.
(5) Planting of sod pieces of perennial grasses.	$2.50 to $4 per acre	Western Texas and Oklahoma, Kansas, Colorado, New Mexico, and California.
(6) Green manure and cover crops plowed or disked under or (in some instances) left on the land.	$0.50 to $2.50 per acre [3]	All States in the Northeast, East Central, and Southern regions and limited areas in the Western region.
(7) (*a*) Renovation of perennial legumes.	$2 per acre	Arizona and New Mexico.
(*b*) Disking in of alfalfa on irrigated land.	$6 per acre	Oregon.
(8) Planting forest trees	$5 to $10 per acre	All States except Arizona and Rhode Island.
(9) Cultivating, protecting, and maintaining a stand of forest trees planted since Jan. 1, 1934.	$4 per acre	Nebraska and South Dakota; all States in Western region except California, Arizona, and New Mexico.
(10) Improving the stand of forest trees by cutting weed trees, and thinning or pruning other trees.	$2.50 to $3 per acre	North Central and East Central region, Northeast region except Rhode Island, New Jersey, and Pennsylvania.
(11) Fencing livestock out of farm wood lots normally pastured.	10 to 20 cents per rod of fence.	Northeast region except Rhode Island.
(12) Excluding livestock from maple-sugar orchards.	$1 per acre	Vermont.
(13) Providing windbreaks on muck or sandy soils:		
(*a*) Shrubs	$1 per acre protected	New York.
(*b*) Rows of small grain	25 cents per acre protected.	Do.
(*c*) Strips of small grain not less than 4 feet wide.	1 cent per linear rod not to exceed 30 cents per acre.	California.

[1] The most common rate is $2.50 per acre, this being the rate for the seeding of alfalfa in all States except in the Northeast region, where the rate is $3. The $1 rate applies only to wild white clover in New York and white clover in the East Central region. The $4 rate applies throughout the Western region if a good stand of a perennial legume is obtained and the nurse crop, if any, is not harvested for grain or hay. This rate also applies under like condtions with respect to alfalfa on dry-land farms in Nebraska and South Dakota.

[2] The most common rates are $1.50 and $2 per acre. The $1 rate applies only to the seeding of sweetclover in the North Central and Western regions. The $3 rate applies only in the Western region and on dry-land farms in Nebraska and South Dakota when a good stand is obtained and the nurse crop, if any, is not harvested for grain or hay.

[3] The most common rate is $1 per acre for nonleguminous green manure and winter cover crops and $2 per acre for summer legumes used as green manure crops. The $0.50 rate applies only for special cover and green manure crops in limited areas of the Western region and the $2.50 rate applies to legumes used as green manure crops in the Northeast region.

Exhibit 1.—APPROVED SOIL-BUILDING PRACTICES, ETC.—Continued

Practice	Rate of payment	Area in which practice is applicable
A. General farm practices—Continued.		
(14) Application of ground limestone or its equivalent to cropland or pasture land.	$1.25 to $5 per ton [4]	All States in the Northeast, North Central, East Central, and Southern regions and in Kansas, Oregon, and Washington in the Western region.
(15) Application of superphosphate (16 percent) or its equivalent to soil-conserving crops or pasture.	50 cents per hundredweight.	Southern region.
	60 cents per hundredweight.	East Central and North Central regions and in Idaho, Kansas, Nevada, Oregon, Utah, and Washington.
	64 cents per hundredweight.	Northeast region.
(16) Application of muriate of potash (50 percent) to soil-conserving crops or pasture.	75 cents per hundredweight.	Delaware.
	$1 per hundredweight.	North Central region and Maryland Virginia, West Virginia, and North Carolina.
	$1.50 per hundredweight.	Northeast region.
(17) Application of nitrate of soda (16 percent) or its equivalent to soil-conserving crops or pasture.	64 cents per hundredweight.	Maine, New Hampshire, Vermont, Massachusetts, New Jersey, and Pennsylvania.
(18) Application of manganese sulphate to soil-conserving crops or pasture.	$2 per hundredweight.	Southern region.
(19) Application of basic slag to soil-conserving crops or pasture.	35 cents per hundredweight.	Southern and North Central regions.
(20) Application of gypsum to soil-conserving crops or pasture.	62½ cents per hundredweight.	5 counties in Minnesota.
	$1 per hundredweight.	Idaho and Nevada.
(21) Terracing	40 cents per 100 linear feet.	All States in Southern, North Central, East Central, and Western regions, except West Virginia, Idaho, North Dakota, Oregon, Utah, and Washington.
(22) Gully control:		
(a) Constructing and maintaining permanent dams for diversion of flood waters or filling shallow gullies.	15 cents per cubic yard.	California and Utah.
(b) Construction of straw checks in gullies.	30 cents per 100 feet	Oregon.
(23) Subsoiling	$2 per acre	Virginia and North Carolina.
(24) Diking for floodwater diversion	$1 per acre	Montana.
(25) Approved summer fallowing	50 cents per acre	All States of Western region except Arizona and California.
(26) Protected summer fallow, wind and water erosion control, and weed control:		
(a) Not basin listed	$1.50 per acre	Dry-land farms in Nebraska and South Dakota.
(b) Basin listed	$2 per acre	Do.
(27) Strip cropping and fallowing:		
(a) Alternate rows of sorghums or Sudan grass and fallow.	25 cents per acre	Western Texas and Oklahoma.
(b) Alternate strips of sorghums or Sudan grass and fallow.	35 cents per acre	Do.
(c) Alternate strips (equal width) of small grain or stubble and fallow.	50 cents per acre in fallow.	Idaho, Oregon, and Washington.
(d) Alternate strips (equal width and on the contour) of small grains or stubble and fallow.	75 cents per acre in fallow.	Idaho and Washington.
	$1 for each new acre in fallow.	Oregon.
(e) Establishment of strip cropping and fallow.	$1 per acre of crops or fallow, whichever is smaller.	Colorado, Kansas, Montana, North Dakota, and Wyoming.
(f) Contour strip cropping and fallow.	$1 per acre in strip crops.	New Mexico.
(g) Protected strip fallowing, wind and water erosion control, and weed control.	$2 per acre in fallow	Dry-land farms in Nebraska and South Dakota.
(28) Strip cropping	40 cents per acre	Do.
(29) Contour listing and fallow	$1 per acre	Arizona, California, Colorado, Kansas, Montana, New Mexico, and North Dakota.
(30) Contour listing	25 cents per acre	Western Texas and Oklahoma.
(31) Wind erosion control	$1 per acre	Oregon.

[4] The rate varies with the fineness of the limestone used and the average cost of limestone in the area.

Exhibit 1.—APPROVED SOIL-BUILDING PRACTICES, ETC.—Continued

Practice	Rate of payment	Area in which practice is applicable
A. General farm practices—Continued.		
(32) Growing sorghums, Sudan grass or millet as cover crops to control wind erosion.	$1 per acre	Western Texas and Oklahoma.
	$2 per acre	Colorado, Kansas, and New Mexico
(33) Contour farming	25 cents per acre	Western Texas and Oklahoma.
	50 cents per acre	Kansas.
(34) Contour cultivation and strip cropping.	$2 per acre	New York.
	do	Aroostook County, Maine.
(35) Contour listing of cropland in the process of natural reseeding to native pasture.	$1 per acre	Kansas, Colorado.
(36) Restoration of land to native grass by natural reseeding.	25 cents per acre	Dry-land farms in Nebraska and South Dakota; western Texas and Oklahoma; all of Western region except Arizona and New Mexico.
(37) Restoration of noncrop plowable pastures by nongrazing for entire season.	40 cents per acre	North Central region.
(38) Reseeding pastures	15 cents per pound	California.
	20 cents per pound	All other States in Western region except Arizona and New Mexico.
(39) Contour furrowing pastures:		
(*a*) With dams at regular intervals in furrows.	50 cents per acre	Colorado, Kansas, Wyoming, and dry-land farms in Nebraska and South Dakota.
	5 cents per 100 linear feet not to exceed $2 per acre.	California, Utah.
(*b*) Without dams in furrows	70 cents per acre occupied by furrows.	Southern region.
(40) Ridging pasture land	10 cents per 100 linear feet.	Do.
(41) Fall and winter listing	25 cents per acre	Colorado, Kansas, and Wyoming.
(42) Eradication of noxious perennial weeds:		
(*a*) Chemical treatment	$10 per acre	All of Western region except Kansas and New Mexico.
(*b*) Periodic cultivation	$5 per acre	All of Western region except Kansas.
(*c*) Flooding	do	California.
(43) Sod strips	$2 per acre	New York and Aroostook County, Maine.
(44) Developing farm map and comprehensive farm conservation plan.	$10 plus 5 cents per acre mapped, not to exceed $25.	New Hampshire, Massachusetts, Connecticut, and New Jersey.
(45) Providing garden and milk cow to supply home consumption needs on a farm where the county committee finds that sufficient food has not been produced on farm.	$10	Guilford County, N. C., and White County, Tenn. (experimental program counties).
(46) Border plantings	$1 per acre planted	New Mexico.
B. Special orchard and vineyard practices:		
(1) Application of mulching materials in orchards:		
(*a*) Nonleguminous straw	50 cents per ton	California.
(*b*) Leguminous straw	75 cents per ton	Do.
(*c*) Miscellaneous materials	$1 per ton	North Central region; Kansas, Colorado.
	$2 per ton	East Central region; Northeast region except Pennsylvania, Oregon, Washington.
(2) Plowing or disking in winter cover crops:		
(*a*) Nonlegume	$1 per acre	North Central region; Colorado, New Mexico, Arizona.
(*b*) Legume	$2 per acre	Colorado.
(3) Seeding winter cover crops	$1 per acre	North Central region.
(4) Soybeans, cowpeas, etc., used as green manure or cover crops in orchards.	$2 per acre	North Central region; Colorado.
(5) Renovating nonproductive orchard land by removing trees and stumps, leveling and establishing soil-conserving crops.	$5 per acre	California, Idaho, Oregon and Washington.
	$10 per acre	New York and New Hampshire.
(6) Renovating nonproductive vineyards and establishing soil-conserving crops.	$4 per acre	California.
	$5 per acre	New York.
(7) Planting trees as a windbreak for orchards:		
(*a*) Single rows	25 cents per rod	California.
(*b*) Double rows	35 cents per rod	Do.

Exhibit 1.—APPRROVED SOIL-BUILDING PRRACTICES, ETC.—Continued

Practice	Rate of payment	Area in which practice is applicable
B. Special orchard and vineyard practices —Continued.		
(8) Perennial legumes plowed under	$1 per acre	Utah and Nevada.
(9) Establishing leguminous cover crops in irrigated or subirrigated orchards.	$2 per acre	Montana.
(10) Applying sand to cranberry bogs:		
½ inch evenly distributed	$7.50 per acre	New Hampshire, Massachusetts, and New Jersey.
¾ inch evenly distributed	$11.25 per acre	Do.
1 inch evenly distributed	$15 per acre	Do.
(11) Applying not less than 200 pounds of nitrate of soda (16 percent) to sod or cover crops interplanted in orchards or vineyards and leaving such sod or cover crops in their entirety on the land.	$1 per acre	New York.
C. Special vegetable land practices:		
(1) Nonleguminous green manure crop on vegetable land.	do	North Central region; Kansas, Colorado, New Mexico, Arizona.
(2) Leguminous green manure crop on vegetable land.	$2 per acre	North Central region; Colorado.
(3) Nonleguminous green manure crop replacing soil-depleting crop on vegetable land.	do	North Central and East Central regions.
(4) Leguminous green manure crop replacing soil-depleting crop on vegetable land.	$4 per acre	Do.
(5) Nonleguminous green manure crop replacing vegetables on vegetable land.	$3 per acre	Northeast region.
(6) Leguminous crop replacing vegetables on vegetable land.	$5 per acre	Do.
D. Special range-land practices:		
(1) Natural reseeding of range land by—		
(a) Deferred grazing from beginning of vegetative growth until seed maturity.	⅓ of range allowance for ¼ or range land.	Western range area of Texas and Oklahoma.
	35 cents per month per animal unit of grazing capacity of ranch.	Western region except Wyoming.
	30 cents per month	Wyoming.
	60 percent of range allowance for ¼ of range land.	Western range area of Nebraska and South Dakota.
(b) Limited grazing	50 percent of range allowance.	Do.
(2) Planting forest trees	$10 per acre	Nebraska and South Dakota.
(3) Cultivating and maintaining stand of forest trees.	$4 per acre	Do.
(4) Contour furrowing:		
(a) With dams at regular intervals in furrows.	50 cents per acre	Nebraska, South Dakota, and all States in western region except California and Nevada.
(b) Without dams in furrows	70 cents per acre occupied by furrows.	Western range area of Texas and Oklahoma.
(5) Construction of reservoirs and dams.	15 cents per cubic yard of fill or excavation.	All of western range area in 17 Western States.
(6) Development of springs or seeps	$50 per spring or seep	All States in western region.
(7) Digging wells to promote more even distribution of grazing.	$1 per foot of 4-inch pipe.	Do.
	50 cents per foot of 2-inch pipe.	North Dakota and Montana.
(8) Water spreading to prevent soil washing.	10 cents per 100 linear feet.	All States in western region and Texas and Oklahoma.
(9) Constructing fences where needed to carry out a range building practice.	30 cents per rod	All States in western region and western range area of Texas and Oklahoma.
(10) Reseeding range land	15 cents per pound	California.
	20 cents per pound	All States in western region except Oregon.
	$1 per acre	Oregon.
(11) Rodent control:		
(a) Prairie dogs	7½ cents per acre	Texas, Oklahoma, Arizona, Colorado, Kansas, Nevada, Montana, Utah, and Wyoming.
(b) Ground squirrels	6 cents per acre	Arizona, Colorado, Idaho, Nevada, New Mexico, Oregon, Washington, Montana, Utah, and Wyoming.
(c) Pocket gophers	15 cents per acre	Arizona, Colorado, Idaho, Nevada, New Mexico, Oregon, Washington, Utah, and Wyoming.
(d) Kangaroo rats	5 cents per acre	Texas and Oklahoma.

Exhibit 1.—APPRROVED SOIL-BUILDING PRRACTICES, ETC.—Continued

Practice	Rate of payment	Area in which practice is applicable
D. Special range land practices—Contd.		
(12) Railing sagebrush	50 cents per acre	Idaho.
(13) Installing remote tanks or troughs to promote more even distribution of grazing.	$25 each	California.
(14) Spreader dams	15 cents per cubic yard	Texas and Oklahoma.
(15) Spreader terraces	40 cents per 100 linear feet.	Do.
(16) Rescuing range land from—		
(a) Prickly pear and cactus:		
Light infestation	50 cents per acre	Western range area o Texas and Oklahoma.
Medium infestation	75 cents per acre	Do.
Heavy infestation	$1 per acre	Do.
(b) Mesquite:		
Light infestation	50 cents per acre	Do.
Medium infestation	$1 per acre	Do.
Heavy infestation	$2 per acre	Do.
(c) Cedar:		
Light infestation	75 cents per acre	Do.
Medium infestation	$1 per acre	Do.
Heavy infestation	$1.50 per acre	Do.
(d) Lechuquilla: Heavy infestation	50 cents per acre	Do.

Exhibit 2.—SCHEDULE OF SOIL-BUILDING PRACTICES APPROVED UNDER 1938 AGRICULTURAL CONSERVATION PROGRAM

A. Each of the following practices in the amounts specified shall be counted as one unit: *Provided*, That when the materials specified in items 1, 2, or 3 are applied to biennial or perennial legumes, perennial grasses, winter legumes, lespedeza, crotalaria, or Natal grass seeded or grown in connection with a soil-depleting crop, only such proportionate part, if any, of the material applied shall be counted as is specified by the Agricultural Adjustment Administration.

1. Aplication of 300 pounds of 16-percent superphosphate (or its equivalent) to, or in connection with the seeding of, perennial or biennial legumes, perennial grasses, winter legumes, lespedeza, crotalaria, Natal grass, or permanent pasture.
2. Application of 200 pounds of 50-percent muriate of potash (or its equivalent) to, or in connection with the seeding of, perennial or biennial legumes, perennial grasses, winter legumes, lespedeza, crotalaria, Natal grass, or permanent pasture.
3. Application of 500 pounds of basic slag or rock phosphate to, or in connection with the seeding of, perennial or biennial legumes, perennial grasses, winter legumes, lespedeza, crotalaria, Natal grass, or permanent pasture.
4. Application of 300 pounds of gypsum containing 18-percent sulphur (or its sulphur equivalent).
5. Construction of 200 linear feet of stadard terrace for which proper outlets are provided.
6. Construction of reservoirs and dams—15 cubic yards of material moved in making the fill or excavation.
7. Reseeding depleted pastures with good seed of adapted pasture grasses or legumes—10 pounds of seed.
8. Contour ridging of noncrop open pasture land—750 linear feet of ridge or terrace.
9. Application of 1 ton, air dry weight, of straw or equivalent mulching material, excluding barnyard and stable manure, in commercial orchards or on commercial vegetable land in areas designated by the regional director as areas in which straw normally costs more than $5 per short ton.
10. Application of not less than 2 tons, air dry weight, of straw or equivalent mulching materials, excluding barnyard and stable manure, per acre in commercial orchards or on commercial vegetable land.

11. Application of the following quantities of ground limestone or its equivalent in areas designated by the regional director as areas in which the average cost of ground limestone to farmers is:

(a) Not more than $2.50 per ton	2,000 lb.
(b) More than $2.50 but not more than $3.50 per ton	1,500 lb.
(c) More than $3.50 but not more than $5 per ton	1,000 lb.
(d) More than $5 per ton	800 lb.

12. Application of 1,000 pounds of finely ground limestone (at least 90 percent to pass through a 30-mesh sieve and all finer particles obtained in the grinding process to be included), except to peanuts and commercial vegetables, such limestone to be applied at the rate of not less than 500 pounds nor more than 1,000 pounds per acre.

13. Restoration of noncrop open pasture by nongrazing during the normal pasture season on an acreage equal to one-half of the number of acres of such pasture required to carry one animal unit for a 12-month period.

B. Each acre of the following shall be counted as one unit:

1. Seeding biennial legumes, perennial legumes, perennial grasses (other than timothy or redtop) or mixtures (other than a mixture consisting solely of timothy and redtop) containing perennial grasses, perennial legumes, or biennial legumes (except alfalfa and permanent pasture mixtures qualifying under practice No. 1 of subsection C of this section XIV).

2. Seeding winter legumes, annual lespedeza, annual ryegrass, crotalaria, sesbania, or annual sweetclover.

3. Green manure crops and cover crops (excluding (1) lespedeza, (2) any crop for which credit is given in 1938 under any other practice, (3) wheat on nonirrigated land except in humid areas designated by the Agricultural Adjustment Administration, and (4) such other crops as may be determined as not qualifiable for any area by the Agricultural Adjustment Administration) of which a good stand and good growth is (1) plowed or disked under on land not subject to erosion, or if subject to erosion, such crop is followed by a winter cover crop, or (2) left on land subject to erosion or in orchards or on commercial vegetable or potato land, or on such other land as is designated by the Agricultural Adjustment Administration.

C. Each acre of the following shall be counted as two units:

1. Seeding hardy northern-grown domestic or Canadian alfalfa (applicable only in the Northeast Region).

2. Seeding permanent pasture mixtures containing a full seeding of legumes or grasses, or both, other than timothy and redtop (applicable only in the Northeast Region and on class B farms in the Southern Region).

3. Cultivating, protecting, and maintaining by replanting, if necessary, a good stand of forest trees, planted between January 1, 1934, and January 1, 1938.

4. With prior approval of the county committee improving a stand of forest trees under such approved system of farm woodlot management as is specified by the Agricultural Adjustment Administration.

5. Establishment of permanent vegetative cover by planting sod pieces of perennial grasses.

6. Green manure crops of which a good stand and a good growth is plowed or disced under (applicable only to class B farms in the Western, East Central, and Southern Regions on which the average acreage of land on which commercial vegetables were grown in 1936 and 1937 exceeds 50 percent of the acreage of cropland in the farm in excess of the sum of the potato, tobacco, cotton, and peanut acreage allotments established for the farm).

D. Each acre of the following shall be counted as five units:

1. Planting forest trees (including shrubs in protective plantings) provided such trees are protected and cultivated in accordance with good tree culture practice.

2. Control of seriously infested plots of perennial noxious weeds, designated by the Agricultural Adjustment Administration, on cropland in organized weed-control districts, in accordance with good chemical or tillage methods.

3. Applying sand free from stones or loam to a depth of at least one-half inch on fruiting cranberry bogs.

E. Each 2 acres of the following shall be counted as one unit:

1. Summer legumes not classified as soil-depleting (interplanted or grown in combination with soil-depleting crops) of which a good stand and a good growth is left on the land or plowed or disced under.
2. Renovation of perennial legumes and mixtures of perennial grasses and legumes.
3. Seeding timothy or redtop or a mixture consisting solely of timothy and redtop.
4. Protecting muck land subject to serious wind erosion by establishing or maintaining approved shrub windbreaks.

F. Each 4 acres of the following shall be counted as one unit:

1. Leaving on the land as a protection against wind erosion (only in wind-erosion areas, which will be designated by the regional director) the stalks of sorghums or Sudan grass, classified as soil-depleting, where it is determined by the county committee that such cover is necessary as a protection against wind erosion and the operator's farming plan provides that such cover will be left on the land until the spring of 1939.
2. Restoration of farm wood lots, normally overgrazed, by nongrazing during the normal pasture season. Credit will not be allowed for more than 2 acres of woodland for each animal unit normally grazed on such woodland.
3. Contour listing or furrowing noncrop land.
4. Strip cropping other than for protection of summer-fallowed acreage.
5. Protecting summer-fallowed acreage from wind and water erosion by contour or basin listing, strip cropping, or incorporating small-grain stubble and straw into the surface soil. No credit will be given for this practice on any farm when carried out on light sandy soils or on soils in any area where destruction of the vegetative cover has resulted in the land becoming subject to serious wind erosion.

G. Each 6 acres of the following shall be counted as one unit:

1. Controlling soil erosion by contour cultivation of intertilled crops (applicable only in the Northeast Region).

H. Each 8 acres of the following shall be counted as one unit:

1. Contour farming intertilled crops.
2. Contour listing or basin listing on the contour. No credit will be given for this practice when carried out on protected summer-fallowed acreage or as a part of the seeding operation.

I. Each 10 acres of the following shall be counted as one unit:

1. Contour seeding of small-grain crops.
2. Basin listing (not on the contour). No credit will be given for this practice when carried out on protected summer-fallowed acreage or as a part of the seeding operation.
3. Natural vegetative cover or small-grain stubble of crops harvested in 1938 left on cropland not tilled after July 1, 1938, where it is determined by the county committee that such cover is necessary as a protection against wind erosion and the operator's farming plan provides that such cover will be left on the land until the spring of 1939 (applicable only in wind-erosion areas in Texas, Oklahoma, Kansas, Colorado, and New Mexico, such areas to be designated by the Agricultural Adjustment Administration).

Appendix B.—DATA ON DIVERSION AND ON SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1936 AGRICULTURAL CONSERVATION PROGRAM

Exhibit 3.—DIVERTED ACREAGES WITH RESPECT TO WHICH PAYMENTS WERE MADE UNDER THE 1936 AGRICULTURAL CONSERVATION PROGRAM, BY STATES AND REGIONS

State and region	General	Cotton	Tobacco	Peanuts	Total
Northeast Region:					
Maine	9,756				9,756
New Hampshire	1,721		17		1,738
Vermont	6,982		27		7,009
Massachusetts	2,616		1,427		4,043
Rhode Island	228				228
Connecticut	3,372		3,462		6,834
New York	133,522		258		133,780
New Jersey	11,287				11,287
Pennsylvania	110,940		6,472		117,412
Total	280,424		11,663		292,087
North Central Region:					
Ohio	448,737		10,854		459,591
Indiana	747,503		3,267		750,770
Illinois	1,112,427	495	4		1,112,926
Michigan	380,965				380,965
Wisconsin	773,538		8,534		782,072
Missouri	1,222,734	84,767	1,839		1,309,340
South Dakota	2,012,295				2,012,295
Minnesota	1,630,032		293		1,630,325
Iowa	1,871,914				1,871,914
Nebraska	1,688,874				1,688,874
Total	11,889,019	85,262	24,791		11,999,072
East Central Region:					
Delaware	21,434				21,434
Maryland	64,275		2,819		67,094
Virginia	116,812	17,607	22,118	12,683	169,220
West Virginia	37,162		919		38,081
North Carolina	66,041	382,849	137,887	18,435	605,212
Kentucky	338,934	6,464	126,259	1	471,658
Tennessee	241,900	307,854	35,589	873	586,216
Total	886,558	714,774	325,591	31,992	1,958,915
Southern Region:					
South Carolina	6,718	538,241	17,189	683	362,831
Georgia	4,091	894,851	11,526	51,050	961,518
Florida	13,467	34,292	1,823	5,751	55,333
Alabama	5,404	941,351	61	24,453	971,269
Mississippi	1,154	966,155			967,309
Louisiana	196	443,740			443,936
Arkansas	48,029	807,490		12	855,531
Oklahoma	871,419	875,121		5,622	1,752,162
Texas	1,245,478	3,077,833		14,244	4,337,555
Total	2,195,956	8,579,074	30,599	101,815	10,907,444
Western Region:					
Arizona	14,517	38,416			52,933
California	155,165	31,177			186,342
Colorado	473,194				473,194
Idaho	169,644				169,644
Kansas	1,933,935	162	64		1,934,161
Nevada	5,325				5,325
New Mexico	194,897	29,807			224,704
North Dakota	2,419,620				2,419,620
Oregon	152,999				152,999
Washington	220,810				220,810
Montana	643,431				643,431
Utah	46,794				46,794
Wyoming	78,080				78,080
Total	6,508,411	99,562	64		6,608,037
Grand total	21,760,368	9,478,672	392,708	133,807	31,765,555

Exhibit 4.—NUMBER OF APPLICATIONS FILED, ACREAGE OF CROPLAND COVERED, TOTAL CROPLAND ACREAGE, AND PERCENTAGE OF CROPLAND COVERED, 1936 AGRICULTURAL CONSERVATION PROGRAM, BY STATES AND REGIONS

State and region	Number of applications for payment	Cropland acreage on applications	Total cropland acreage in State [1]	Percentage of cropland covered
Northeast Region:	*Number*	*Acres*	*Acres*	*Percent*
Maine	6,588	440,737	1,476,422	29.9
New Hampshire	2,763	132,414	469,076	28.2
Vermont	5,702	398,000	1,162,726	34.2
Massachusetts	2,998	137,308	635,548	21.6
Rhode Island	142	8,495	81,554	10.4
Connecticut	3,582	161,906	563,359	28.7
New York	35,466	2,883,386	8,850,247	32.6
New Jersey	3,795	335,478	1,105,579	30.3
Pennsylvania	37,801	2,555,348	8,298,581	30.8
Total	98,837	7,053,072	22,643,131	31.1
North Central Region:				
Ohio	126,725	8,091,417	12,875,572	62.8
Indiana	114,905	8,476,960	13,523,837	62.7
Illinois	137,474	13,192,834	23,078,768	57.2
Michigan	112,508	7,350,939	10,731,946	68.5
Wisconsin	156,808	10,073,283	11,578,447	87.0
Missouri	161,429	11,226,429	16,054,617	69.9
South Dakota	89,374	14,779,778	16,842,968	87.8
Minnesota	127,994	14,119,128	19,469,395	72.5
Iowa	154,519	17,593,627	24,228,896	72.6
Nebraska	106,255	14,691,809	20,446,092	71.9
Total	1,287,991	119,596,204	168,830,538	70.8
East Central Region:				
Delaware	3,091	275,200	543,864	50.6
Maryland	13,274	1,328,933	2,296,577	57.9
Virginia	46,105	3,002,164	6,087,590	49.3
West Virginia	15,358	683,000	2,159,891	31.6
North Carolina	108,316	4,969,000	7,458,914	66.6
Kentucky	109,258	8,215,794	8,852,021	92.8
Tennessee	87,346	6,220,977	8,684,116	71.6
Total	382,748	24,695,068	36,082,973	68.4
Southern Region:				
South Carolina	71,761	4,004,037	5,309,887	75.4
Georgia	103,300	7,598,914	10,890,102	69.8
Florida	20,619	1,240,535	2,181,676	56.9
Alabama	128,731	6,635,430	8,448,182	78.5
Mississippi	83,215	6,087,720	7,743,426	78.6
Louisiana	64,651	3,373,426	4,924,636	68.5
Arkansas	98,355	6,700,478	8,115,013	82.6
Oklahoma	98,250	10,332,404	17,172,008	60.2
Texas	198,430	23,914,969	35,924,410	66.6
Total	867,312	69,887,913	100,709,340	69.4
Western Region:				
Arizona	2,453	350,814	688,267	51.0
California	20,597	3,827,004	10,166,257	37.6
Colorado	29,143	5,078,387	9,021,851	56.3
Idaho	18,879	2,051,229	3,851,229	53.3
Kansas	99,506	16,309,064	29,094,095	56.1
Nevada	1,270	224,800	462,312	48.6
New Mexico	13,325	1,631,539	2,473,229	66.0
North Dakota	110,777	21,880,869	24,894,570	87.9
Oregon	13,305	1,769,251	4,020,562	44.0
Washington	15,639	2,599,595	6,131,887	42.4
Montana	31,296	7,660,942	10,714,720	71.5
Utah	14,658	1,017,047	1,374,477	74.0
Wyoming	6,482	971,056	2,257,282	43.0
Total	377,330	65,371,597	105,150,738	62.2
Grand Total	3,014,218	286,603,854	433,416,720	66.1

[1] Includes estimated acreages of rotation pasture classified as cropland under the 1936 Agricultural Conservation Program.

Exhibit 6.—ACREAGE OF TERRACING, LISTING, CONTROLLED SUMRIED OUT UNDER THE 1936 AGRICULTURAL CONSERVATION PROGRAM, BY STATES AND REGIONS

State and region	Seeding legumes and legume mixtures [1]	Seeding perennial grasses for pasture establishment [2]	Growing green manure and cover crops [3]	Planting forest trees
Northeast Region:	*Acres*	*Acres*	*Acres*	*Acres*
Maine	61,877		3,623	16
New Hampshire	12,678		525	85
Vermont	47,109			154
Massachusetts	4,634		7,343	53
Rhode Island	337	33	827	
Connecticut	7,625		10,479	27
New York		2,781	44,988	868
New Jersey	29,451		69,863	45
Pennsylvania	510,698		21,539	606
Total	674,409	2,814	159,187	1,854
North Central Region:				
Ohio	1,815,704	4,332	39,078	152
Indiana	1,794,633	26,484	82,770	56
Illinois	2,163,733	120,699	213,593	41
Michigan	1,298,755	1,613	33,731	159
Wisconsin	2,034,501	17,440	15,333	315
Missouri	1,818,191	175,446	77,822	35
South Dakota	826,028	26,457	98	2,522
Minnesota	2,176,292	45,904	14,650	996
Iowa	3,605,011	7,782	44,900	140
Nebraska	1,084,364	45,074	842	6,465
Total	18,617,212	471,231	522,817	10,881
East Central Region:				
Delaware	53,239	312	17,354	13
Maryland	299,469	7,763	32,735	70
Virginia	525,848	43,091	109,396	370
West Virginia	92,105	15,434	13,856	72
North Carolina	465,571	19,115	535,289	395
Kentucky	1,461,261	561,577	134,981	267
Tennessee	1,230,142	108,706	205,816	726
Total	4,127,635	755,998	1,049,427	1,913
Southern Region:				
South Carolina	94,382	4,746	610,930	1,030
Georgia	117,460	8,754	1,291,324	4,332
Florida	5,218	1,722	505,216	1,329
Alabama	348,791	20,978	1,194,743	521
Mississippi	468,996	11,594	1,196,109	1,583
Louisiana	108,109	21,196	662,100	138
Arkansas	397,240	47,834	799,343	144
Oklahoma	284,870	24,073	899,394	967
Texas	109,319	169,117	3,592,433	5,177
Total	1,934,385	310,014	10,751,592	15,221
Western Region:				
Arizona	39,637		7,813	
California	163,345	7,209	154,718	119
Colorado	219,239	3,840	61,351	90
Idaho	223,162	15,046	73,209	7
Kansas	407,466	28,112	253,843	577
Nevada	17,037	735	540	
New Mexico	44,897		169,155	
North Dakota	1,339,341	58,901	1,024	854
Oregon	137,895	46,313	83,892	13
Washington	103,013	35,187	92,111	2
Montana	272,114	42,193	305,235	130
Utah	84,652	1,013	844	3
Wyoming	109,962	3,044	569	94
Total	3,161,760	241,593	1,204,304	1,889
Grand total	28,515,401	1,781,650	13,687,327	31,758

[1] Includes annual legumes and nonclassified legumes and grasses in the western region; excludes, in most cases, legumes for green manure.
[2] Includes some grass and legume mixtures.
[3] Includes summer legumes left on the land and green-manure crops grown in orchards.

Exhibit 6.—ACREAGE OF TERRACING, LISTING, CONTROLLED SUMMER FALLOWING, AND MISCELLANEOUS PRACTICES CARRIED OUT UNDER THE 1936 AGRICULTURAL CONSERVATION PROGRAM, BY STATES AND REGIONS

State and region	Terracing	Listing	Controlled summer fallowing	Miscellaneous practices
Northeast Region:	*Acres*	*Acres*	*Acres*	*Acres*
New York				[1] 37
Total				[1] 37
North Central Region:				
Indiana	491		3	
Missouri	12,378			
South Dakota			240,043	[2] 4,638
Nebraska	1,273		44,244	[2] 44,291
Total	14,142		284,290	[2] 48,929
East Central Region:				
Maryland	25			[3] 24
Virginia	5,231			[3] 244
North Carolina	26,485			[3] 770
Kentucky	8,584			
Tennessee	63,150			
Total	103,475			[3] 1,038
Southern Region:				
South Carolina	30,847			
Georgia	45,335			
Florida	6,641			
Alabama	130,982			
Mississippi	28,648			
Louisiana	6,830			
Arkansas	33,450			
Oklahoma	84,093	382,873		
Texas	225,133	795,082		
Total	591,959	1,177,955		
Western Region:				
Arizona	3,433		37,236	[4] [5] 569
California	948		856,797	[4] [6] 12,454
Colorado	2,211	99,347	67,876	
Idaho			62,114	[4] 5,802
Kansas	9,124		226,198	
Nevada			1,452	[4] 845
New Mexico	3,088		9	
North Dakota			713,126	
Oregon			115,423	[4] 6,197
Washington			538,962	[4] 8,359
Montana	127		505,876	[7] 7,419
Utah	26		158,066	[4] [6] 2,502
Wyoming	58	3,458	17,488	
Total	19,015	102,805	3,200,623	44,147
Grand total	728,591	1,280,760	3,584,913	94,151

[1] Windbreaks.
[2] Rye grown as nurse crop.
[3] Subsoiling.
[4] Weed control.
[5] Leaching.
[6] Gully control.
[7] Diking for flood diversion.

Exhibit 7.—ACREAGES ON WHICH SPECIFIED FERTILIZERS AND LIME WERE APPLIED UNDER THE 1936 AGRICULTURAL CONSERVATION PROGRAM, BY STATES AND REGIONS

State and region	Fertilizer and lime applications		
	Limestone only	Phosphates only (including basic slag)	Other fertilizers
	Acres	*Acres*	*Acres*
Northeast Region:			
Maine	29,683	4,927	2,166
New Hampshire	4,291	5,514	3,617
Vermont	9,154	27,438	8,122
Massachusetts	5,569	11,980	8,008
Rhode Island	634	1,393	480
Connecticut	10,644	10,164	7,625
New York	128,648	269,333	10,503
New Jersey	16,607	22,346	12,600
Pennsylvania	140,330	141,848	3,642
Total	345,560	494,943	56,763
North Central Region:			
Ohio	143,916	3,271	77
Indiana	131,600	1,697	225
Illinois	256,032	5,278	
Michigan	98,345	4,638	
Wisconsin	220,787	8,248	1,562
Missouri	96,289	15,002	4
South Dakota			
Minnesota	18,841	460	1,193
Iowa	155,149	893	22
Nebraska	115		
Total	1,121,074	39,487	3,083
East Central Region:			
Delaware	3,974	663	662
Maryland	74,210	12,275	2,259
Virginia	133,598	130,683	7,836
West Virginia	37,489	34,341	
North Carolina	26,334	11,257	5,109
Kentucky	333,517	150,031	
Tennessee	105,742	44,109	
Total	714,864	383,359	15,866
Southern Region:			
South Carolina	1,139	2,904	
Georgia	3,187	8,128	35
Florida	4,460	28,760	10,470
Alabama	4,461	46,477	524
Mississippi	5,337		
Louisiana	685	139	
Arkansas	3,340		
Oklahoma	526	1,079	
Texas		5,630	
Total	23,135	93,117	11,029
Western Region:			
Arizona			
California			
Colorado			
Idaho			
Kansas	3,944		
Nevada			
New Mexico			
North Dakota			
Oregon	1,634		
Washington			
Montana			
Utah			
Wyoming			
Total	5,578		
Grand total	2,210,211	1,010,906	86,741

Exhibit 8.—RANGE-BUILDING PRACTICES CARRIED OUT ON LIVESTOCK RANCHES PARTICIPATING IN THE 1936 RANGE PROGRAM IN THE WESTERN REGION, BY STATES

State	Contouring	Spring or seep	Pits or reservoirs	Wells	Water spreading	Fences	Reseeding	Rodent control	Fire guards	Railing sagebrush
	Acres	*Linear feet*	*Cubic yards*	*Linear feet*	*Linear feet*	*Rods*	*Acres*	*Acres*	*Linear feet*	*Acres*
Arizona		72	389,537	3,929	26,000	157,940				
California	75	1,702	260,775	7,161		209,473			79,000	
Colorado	5,947	430	207,580	12,731	678,134	154,694	1,130			403
Idaho		859	30,098	1,096		52,766	3,214			174
Kansas			454,290	14,863	346,164					
Montana	657	1,405	861,749	11,455	253,221	215,608	9,294		97,449	
Nevada		15	320			2,181	208			
New Mexico	4,466	214	2,067,042	42,307	89,056	1,134,229		135,598	356,400	
North Dakota		468	157,850	5,417		115,786	2,131			
Oregon		1,658	36,747	2,398	463,788	178,591	17,604	687	1,333	
Utah		67	23,039	653		19,696	1,065			567
Washington	193	617	45,958	484	5,715	86,910	622		31,680	
Wyoming	678	930	695,166	27,063	37,985	196,758	1,579			
Total	12,016	8,437	5,230,151	129,557	1,900,063	2,524,632	36,847	136,285	565,862	1,144

Appendix C.—DATA ON DIVERSION AND ON SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1937 AGRICULTURAL CONSERVATION PROGRAM (PRELIMINARY)

Exhibit 9.—DIVERTED ACREAGES WITH RESPECT TO WHICH PAYMENTS WERE MADE UNDER THE 1937 AGRICULTURAL CONSERVATION PROGRAM, BY STATES AND REGIONS (PRELIMINARY)

State and region	Acres diverted for payment				
	General	Cotton	Tobacco	Peanuts	Total
Northeast Region:					
Maine	19,635				19,635
New Hampshire			2		2
Vermont			2		2
Massachusetts			803		803
Connecticut			1,527		1,527
New York			145		145
Pennsylvania	29,795		2,199		31,994
Total	49,430		4,678		54,108
North Central Region:					
Ohio	278,000		3,900		281,900
Indiana	323,278		829		324,107
Illinois	500,000	300			500,300
Michigan	321,353				321,353
Wisconsin	514,131		5,100		519,231
Missouri	1,128,947	32,401	998		1,162,346
South Dakota	1,682,637				1,682,637
Minnesota	1,195,713		53		1,195,766
Iowa	1,126,503				1,126,500
Nebraska	1,173,040				1,173,043
Total	8,243,602	32,701	10,880		8,287,183
East Central Region:					
Delaware	23,510				23,510
Maryland	52,973		3,346		56,319
Virginia	122,677	14,240	18,901	7,250	163,068
West Virginia	42,583		743		43,326
North Carolina	54,589	310,766	97,539	12,303	475,197
Kentucky	340,285	5,507	98,559		444,351
Tennessee	225,954	242,333	25,819	665	494,771
Total	862,571	572,846	244,907	20,218	1,700,542
Southern Region:					
South Carolina	36,000	431,000	5,200	200	472,400
Georgia	4,500	646,000	11,200	30,400	692,100
Florida	33,000	17,800	1,100	3,200	55,100
Alabama	20,000	773,000	33	18,000	811,033
Mississippi	600	755,000			755,600
Louisiana	5,500	388,000			393,500
Arkansas	135,000	704,000			839,000
Oklahoma	789,000	695,000		2,800	1,486,800
Texas	1,359,000	2,762,000		17,000	4,138,000
Total	2,382,600	7,171,800	17,533	71,600	9,643,533
Western Region:					
Arizona	14,629	31,580			46,209
California	166,557	18,938			185,495
Colorado	734,117				734,117
Idaho	134,976				134,976
Kansas	1,754,356	153	20		1,754,529
Nevada	3,103				3,103
New Mexico	161,123	17,475			178,598
North Dakota	2,172,756				2,172,756
Oregon	194,370				194,370
Washington	161,313				161,313
Montana	952,805				952,805
Utah	47,801				47,801
Wyoming	111,100				111,100
Total	6,609,006	68,146	20		6,677,172
Grand total	18,147,209	7,845,493	278,018	91,818	26,362,538

Exhibit 10.—SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1937 AGRICULTURAL CONSERVATION PROGRAM, BY STATES AND REGIONS (PRELIMINARY)

State and region	New seedings					
	Alfalfa [1]	Winter legumes	Lespedeza and other summer legumes	Other legumes and legume mixtures	Perennial grasses	Total
Northeast Region:	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Maine				86,344		86,344
New Hampshire	1,610			16,826		18,436
Vermont	5,946			9,219		15,165
Massachusetts	2,252			11,989		14,241
Rhode Island	257			1,071		1,328
Connecticut	2,907			6,771		9,678
New York	73,992			337,346		411,338
New Jersey	26,915			54,619		81,534
Pennsylvania	112,924			423,439		536,363
Total	226,803			947,624		1,174,427
North Central Region:						
Ohio	239,400			1,358,200	375,700	1,973,300
Indiana	161,699			822,751	246,244	1,230,694
Illinois	140,000			1,064,000	275,975	1,479,975
Michigan	451,096			636,133	36,734	1,123,963
Wisconsin	663,426			1,345,969	199,459	2,208,854
Missouri	93,648			982,743	1,286,863	2,363,254
South Dakota	145,583			315,015	34,838	495,436
Minnesota	344,489			1,396,323	132,825	1,873,637
Iowa	298,338			1,821,970	320,295	2,440,603
Nebraska	259,792			419,080	38,110	716,982
Total	2,797,471			10,162,184	2,947,043	15,906,698
East Central Region:						
Delaware	1,247	39,951	11,780	62,528	116	115,622
Maryland	14,775	28,056	28,101	385,500	854	457,286
Virginia	16,387	59,712	189,378	350,457	5,582	621,516
West Virginia	12,353	8,252	10,522	190,410	3,544	225,081
North Carolina	1,609	94,037	386,562	68,998	1,785	552,991
Kentucky	64,263	24,978	843,317	1,047,642	168,066	2,148,266
Tennessee	23,160	148,426	843,656	322,683	13,580	1,351,505
Total	133,794	403,412	2,313,316	2,428,218	193,527	5,472,267
Southern Region:						
South Carolina	800	50,000			2,000	52,800
Georgia	3,100	223,000			14,000	240,100
Florida	20	4,700			28,000	32,720
Alabama	2,000	425,000			28,000	455,000
Mississippi	16,500	718,000			30,000	764,500
Louisiana	8,500	238,000			34,000	280,500
Arkansas	25,000	783,000			84,000	892,000
Oklahoma	79,000	107,000			74,500	260,500
Texas	35,000	150,000			204,000	389,000
Total	169,920	2,698,700			498,500	3,367,120
Western Region:						
Arizona	36,603			6,874	60	43,537
California	183,558			11,685	6,500	201,743
Colorado	163,846			69,079	3,613	236,538
Idaho	140,156			30,743	5,414	176,313
Kansas	108,114			168,948	13,702	290,764
Nevada	14,106			2,468	666	17,240
New Mexico	25,905			8,816	1,460	36,181
North Dakota	85,940			808,405	89,336	983,681
Oregon	112,260			72,106	37,372	221,738
Washington	72,822			51,526	10,166	134,514
Montana	224,215			226,398	140,363	590,976
Utah	79,937			13,570	878	94,385
Wyoming	73,087			39,982	10,679	123,748
Total	1,320,549			1,510,600	320,209	3,151,358
United States total	4,648,537	3,102,112	2,313,316	15,048,626	3,959,279	29,071,870

[1] Includes Kudzu in Southern Region and all perennial legumes in Western Region.

Exhibit 10.—SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1937 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Continued

State and region	Green manure and cover crops					Mulching orchards
	Summer legumes	Winter legumes	On orchard and commercial vegetable land	Other and unclassified	Total	
Northeast Region:	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Maine				16,831	16,831	400
New Hampshire				1,071	1,071	200
Vermont				260	260	200
Massachusetts				11,047	11,047	700
Rhode Island				2,900	2,900	
Connecticut				18,542	18,542	200
New York				95,231	95,231	20,000
New Jersey				163,042	163,042	8,000
Pennsylvania				57,722	57,722	3,000
Total				366,646	366,646	32,700
North Central Region:						
Ohio			7,300		7,300	3,900
Indiana			789		789	707
Illinois			2,990		2,990	750
Michigan			45,919		45,919	2,162
Wisconsin			3,386		3,386	802
Missouri			587		587	379
South Dakota						
Minnesota			105		105	
Iowa			252		252	100
Nebraska						
Total			61,328		61,328	8,800
East Central Region:						
Delaware	8,661	18,344	521	8,432	35,958	
Maryland	19,913	17,676	5,554	23,320	66,463	52
Virginia	119,754	27,555	6,569	69,372	223,250	200
West Virginia	8,070	3,550	8,472	6,750	26,842	909
North Carolina	795,674	33,124	2,338	118,781	949,917	26
Kentucky	192,973	6,133	7,936	75,119	282,161	856
Tennessee	385,928	21,640	153	18,632	426,353	148
Total	1,530,973	128,022	31,543	320,406	2,010,944	2,191
Southern Region:						
South Carolina	318,000	2,000	400	8,000	328,400	
Georgia	659,000	90,000	5,100	21,000	775,100	
Florida	195,000	800	286,000	147,900	629,700	
Alabama	160,000	245,000	800	6,100	411,900	
Mississippi	242,000	432,000	1,300	3,900	679,200	
Louisiana	311,000	92,000	2,103	7,200	412,303	
Arkansas	315,000	188,000	900	53,000	556,900	
Oklahoma	109,000	21,000	1,500	1,251,000	1,382,500	
Texas	698,000	8,000	19,000	2,187,000	2,912,000	
Total	3,007,000	1,078,800	317,103	3,685,100	8,088,003	
Western Region:						
Arizona			44	7,569	7,613	
California	8,497	271,838	287,911	402,167	970,413	15,994
Colorado		43		107,973	108,016	1,063
Idaho	2,031			10,568	12,599	
Kansas	21,869	58		166,091	188,018	328
Nevada	103		11	242	356	
New Mexico	10,249		472	337,381	348,102	
North Dakota	517			7,589	8,106	
Oregon				59,175	59,175	2,213
Washington				49,428	49,428	2,367
Montana	557		44	2,743	3,344	
Utah	583		955	3,866	5,404	
Wyoming						
Total	44,406	271,939	289,437	1,154,792	1,760,574	21,965
United States total	4,582,379	1,478,761	699,411	5,526,944	12,287,495	65,656

Exhibit 10.—SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1937 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Continued

State and region	Forest tree practices				Weed control	
	Acreage planted	Acreage maintained	Acreage improved	Total	Chemical	By cultivation
Northeast region:	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Maine	82		802	884		
New Hampshire	158		1,965	2,123		
Vermont	347		715	1,062		
Massachusetts	102		584	686		
Rhode Island	5			5		
Connecticut	205		211	416		
New York	2,415		493	2,908		
New Jersey	153			153		
Pennsylvania	2,842			2,842		
Total	6,309		4,770	11,079		
North Central Region:						
Ohio	260		50	310		
Indiana	11			11		
Illinois	120			120		
Michigan	692		9,160	9,852		
Wisconsin	290		953	1,243		
Missouri	453		299	752		
South Dakota	3,499		94	3,593		
Minnesota	1,428		26,588	28,016		
Iowa	215		1	216		
Nebraska	3,866	1,048	52	4,966		
Total	10,834	1,048	37,197	49,079		
East Central Region:						
Delaware	51		3	54		
Maryland	109		62	171		
Virginia	287		344	631		
West Virginia	170		581	751		
North Carolina	422		1,108	1,530		
Kentucky	600		1,457	2,057		
Tennessee	1,636		183	1,819		
Total	3,275		3,738	7,013		
Southern Region:						
South Carolina	400			400		
Georgia	4,300			4,300		
Florida	2,400			2,400		
Alabama	700			700		
Mississippi	900			900		
Louisiana	1,300			1,300		
Arkansas	400			400		
Oklahoma	500			500		
Texas	100			100		
Total	11,000			11,000		
Western Region:						
Arizona					37	1,538
California	450			450	1,540	[1] 13,727
Colorado	389	217		606	320	1,823
Idaho	4	9		13	76	3,073
Kansas	242	1,752		1,994		
Nevada	2			2	17	260
New Mexico	450	155		605		6,978
North Dakota	1,485	2,007		3,492	951	8,343
Oregon	19	24		43	526	9,361
Washington	22	12		34	1,997	3,994
Montana	112	1,874		1,986	879	4,225
Utah	865			865	131	2,641
Wyoming	89	290		379	29	327
Total	4,129	6,340		10,469	6,503	56,290
United States total	35,547	7,388	45,705	88,640	6,503	56,290

[1] Includes 743 acres flooded.

Exhibit 10.—SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1937 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Continued

State and region	Fertilizer and lime applications						
	Limestone	Phosphate	Basic slag	Potash	Gypsum	Other [3]	Total
Northeast Region:	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Maine	37,975	4,803		785		1,361	44,924
New Hampshire	16,198	2,865		422		1,241	20,726
Vermont	33,401	15,594		860		1,506	51,361
Massachusetts	26,521	3,353		629		2,269	32,772
Rhode Island	2,789	526		103		227	3,645
Connecticut	34,609	4,623		223		2	39,457
New York	268,468	123,402		201		3,596	395,667
New Jersey	111,836	7,575		1,240		2,743	123,394
Pennsylvania	502,317	55,814		741		4,000	562,872
Total	1,034,114	218,555		5,204		16,945	1,274,818
North Central Region:							
Ohio	293,000	768	12	2			293,782
Indiana	249,211	49		3			249,263
Illinois	645,000	115	1,425	8	116		646,664
Michigan	251,909	1,018		249			253,176
Wisconsin	406,000	1,407	84	177	2		407,670
Missouri	195,720	1,503	10				197,233
South Dakota		2					21
Minnesota	31,221	487	1	5			31,714
Iowa	218,557	310	14	3			218,884
Nebraska	100	19					119
Total	2,290,718	5,678	1,546	447	118		2,298,507
East Central Region:							
Delaware	19,238	1,125		86			20,449
Maryland	148,157	6,680		782			155,619
Virginia	291,102	23,382		324			314,808
West Virginia	152,883	15,679		118			168,680
North Carolina	63,493	2,302		34			65,829
Kentucky	642,642	61,479					704,121
Tennessee	255,864	16,230					272,094
Total	1,573,379	126,877		1,344			1,701,600
Southern Region:							
South Carolina	1	160					161
Georgia	1,500	425	900			6	2,831
Florida	28,100	8,258	1,226			119	37,703
Alabama	2	9	45				56
Mississippi	414	125	2,856			22	3,417
Louisiana	2	1	72				75
Arkansas	1	1					2
Oklahoma	1	1					2
Texas		1,250				62	1,312
Total	30,021	10,230	5,099			209	45,559
Western Region:							
Idaho		367			408		775
Kansas	43,141	727					43,868
Nevada		3					3
Oregon	16,955	500			2,203		19,658
Washington	1,512	389					1,901
Utah		136					136
Total	61,608	2,122			2,611		66,341
United States total	4,989,840	363,462	6,645	6,995	2,729	17,154	5,386,825

[3] Nitrogen in the Northeast Region and Manganese Sulphate in the Southern Region.

Exhibit 10.—SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1937 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Continued

State and region	Fallow				Contour furrowing and ridging pasture land	Contour listing pasture land
	Strip fallow	Contour or basin listed fallow	Other protected fallow	Total fallow		
North Central Region:	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*1,000 feet*
South Dakota	86,423	15,160	1,617,870	1,719,453	831	
Nebraska	17,386	73,992	724,172	815,550	804	
Total	103,809	89,152	2,342,042	2,535,003	1,635	
Southern Region:						
South Carolina					1,000	200
Georgia					40	
Mississippi					2,000	159
Louisiana					20	
Oklahoma	79,000			79,000	66,000	487
Texas	75,000			75,000	6,200	1,965
Total	154,000			154,000	75,260	2,811
Western Region:						
Arizona		35		35		
Colorado	2,700	49,568	486,342	538,610	2,065	
Idaho			98,886	98,886		
Kansas	3,899	124,538	2,576,602	2,705,039	14,147	
New Mexico	64,375	44,624	46,423	155,422		
North Dakota		2,196	863,473	865,669		
Oregon	96		210,707	210,803		
Washington			467,267	467,267		
Montana	273,810	10,488	1,307,346	1,591,644	3,227	
Utah			139,574	139,574		
Wyoming	12,253	3,004	68,449	83,706	49	
Total	357,133	234,453	6,265,069	6,856,655	19,488	
United States total	614,942	323,605	8,607,111	9,545,658	96,383	2,811

Exhibit 10.—SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1937 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Continued

State and region	Terracing	Other erosion-control practices				
		Contour strip cropping	Other strip cropping	Contour or basin listing	Contour farming	Total
Northeast region:	*1,000 feet*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Maine			82		442	524
New York			2,056			2,056
Total			2,138		442	2,580
North Central Region:						
Ohio		1,100				1,100
Illinois	130	50				50
Missouri	31	71				71
South Dakota	4	2,029	26,172			28,201
Minnesota		720				720
Iowa	37	10				10
Nebraska	217	254	25,551			25,805
Total	419	4,234	51,723			55,957
East Central Region:						
Virginia	1,761					
North Carolina	10,535					
Kentucky	731					
Tennessee	11,475					
Total	24,502					
Southern Region:						
South Carolina	8,200					
Georgia	31,559					
Florida	2,959					
Alabama	74,875					
Mississippi	44,181					
Louisiana	1,060					
Arkansas	10,895					
Oklahoma	17,442			1,816,000	209,000	2,025,000
Texas	64,600			1,977,000	1,380,000	3,357,000
Total	255,771			3,793,000	1,589,000	5,382,000
Western Region:						
Arizona	95					
California	121			128		128
Colorado	159			255,627	43,635	299,262
Kansas	6,247	415		59,534	156,711	216,660
New Mexico	6,525	30,621		535,633		566,254
North Dakota		3,933	281,476	933		286,342
Oregon				508		508
Montana	19			9,959		9,959
Wyoming	11			2,900		2,900
Total	13,177	34,969	281,476	865,222	200,346	1,382,013
United States total	293,869	39,203	335,337	4,658,222	1,789,788	6,822,550

Exhibit 10.—SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1937 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Continued

State and region	Restoration of noncrop pasture land by deferred grazing	Restoration to native cover	Reseeding pastures	Fencing	Miscellaneous
Northeast Region:	*Acres*	*Acres*	*Acres*	*Rods*	*Acres*
Maine				8,787	
New Hampshire				7,388	[4] 1,960
Vermont				15,590	[5] 8,870
Massachusetts				7,774	[6] 2,474
Rhode Island					[7] 10
Connecticut				4,207	[8] 1,904
New York				82,347	[9] 7,823
New Jersey				7,862	[10] 8,590
Pennsylvania				27,506	
Total				161,461	
North Central Region:					
Ohio	10				
Illinois	10				
Wisconsin	1				[7] 146
Missouri	1,515				
South Dakota	69,027	25,662			
Iowa	28				
Nebraska	26,469	15,695			
Total	97,060	41,357			
East Central Region:					
Virginia					[11] 669
North Carolina					[11] 4,250
Total					4,919
Southern Region:					
Oklahoma		3,000			
Texas		21,000			
Total		24,000			
Western Region:					
California		726	623		[11] 1,597
Colorado		78,797	1,098		
Idaho		3,600	2,109		
Kansas		12,063	31,916		
Nevada		20	60		
North Dakota		15,769	4,768		
Oregon		80,655	30,110		
Washington		35,118	21,253		
Montana		17,412	870		
Utah		3,918	6,358		
Wyoming		33,226	1,963		
Total		281,304	101,128		
United States total	97,060	346,661	101,128	161,461	

[4] 1,796 acres under a farm plan; 164 acres from which unproductive orchard trees were removed.
[5] Acres of maple-sugar orchards normally pastured from which livestock were excluded.
[6] 1,883 acres of cranberry bogs sanded; 591 acres under a farm plan.
[7] Acres of cranberry bogs sanded.
[8] Acres under a farm plan.
[9] 7,411 acres from which unproductive orchard trees or vines were removed and 412 acres protected by windbreaks.
[10] 8,028 acres under a farm plan; 562 acres of cranberry bogs sanded.
[11] Acres of subsoiling.

Appendix D.—STATISTICS ON SURPLUS-REMOVAL OPERATIONS OF THE FEDERAL SURPLUS COMMODITIES CORPORATION

Exhibit 11.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, BY STATES, COMMODITIES, AND SOURCES OF FUNDS, NOV. 18, 1935, THROUGH JUNE 30, 1936 [1]

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalent	Commodity	Transportation	Total
WASHINGTON						
Apples, fresh	State	377,668 bushels	630	$264,367.60		$264,367.60
Do	Section 32	420,336 bushels	700	264,448.45	$78,022.00	342,470.45
Onions	do	50,000 pounds	2	300.00	83.36	383.36
Peas, dried	do	4,081,515 pounds	68	70,975.99	25,405.56	96,381.55
Peas, fresh	State	642,405 pounds	11	[2] 24,050.17		24,050.17
Prunes, dried	Section 32	480,000 pounds	8	17,760.00	3,631.04	21,391.04
Wheat, for flour	do	1,781,894 bushels	1,283	[3] 1,626,890.83	410,842.26	2,037,733.09
Total			2,702	2,268,793.04	517,984.22	2,786,777.26
TEXAS						
Cotton, raw	Section 32	26,034 bales	521	1,378,702.60	87,142.46	1,465,845.06
Cotton mats	do	31,512 pieces	35	156,145.08	3,966.55	160,111.63
Eggs, shell	do	4,000 cases	10	21,600.00	506.30	22,106.30
Onions	do	21,682,400 pounds	851	217,144.70	170,885.82	388,030.52
Total			1,417	1,773,592.38	262,501.13	2,036,093.51
CALIFORNIA						
Apples, fresh	State	46,871 bushels	78	42,695.86		42,695.86
Do	Section 32	46,860 bushels	78	37,487.98	8,693.88	46,181.86
Beans, dried	State	600,000 pounds	12	16,025.00		16,025.00
Cotton, raw	Section 32	57 bales	1	3,058.01	167.26	3,225.27
Figs, dried	State	600,000 pounds	10	22,500.00		22,500.00
Grapefruit	Section 32	19,098 boxes	32	14,263.50	10,266.24	24,529.74
Milk, dry skim	Jones-Connally	40,013 pounds	1	2,871.90		2,871.90
Milk, evaporated	do	34,400 cases	43	78,952.00		78,952.00
Onions	Section 32	4,890,000 pounds	192	44,010.00	38,562.40	82,572.40
Oranges	do	198,282 boxes	331	194,459.50	105,095.86	299,555.36
Prunes, dried	State	6,000,000 pounds	100	256,308.90		256,308.90
Do	Section 32	14,689,500 pounds	245	658,109.59	111,200.60	769,310.19
Total			1,123	1,370,742.24	273,986.24	1,644,728.48
NEW YORK						
Apples, fresh	State	47,526 bushels	79	32,439.03		32,439.03
Do	Section 32	327,191 bushels	545	213,108.73	60,745.70	273,854.43
Butter	Jones-Connally	790,129 pounds	42	244,622.40		244,622.40
Cabbage	Section 32	44,786 pounds	2	156.76		156.76
Carrots	do	2,637,400 pounds	110	24,658.80	2,320.00	26,978.80
Cheese	Jones-Connally	71,579 pounds	3	11,066.77		11,066.77
Cotton, raw	Section 32	170 bales	4	8,528.71	669.04	9,197.75
Eggs, shell	do	21,815 cases	55	138,473.28	2,784.65	141,257.93
Milk, dry skim	Jones-Connally	189,300 pounds	5	13,774.40		13,774.40
Oat cereal, enriched	State	1,307,088 pounds	32	Exchange		Exchange
Onions	Section 32	1,859,550 pounds	73	17,790.87	3,042.64	20,833.51
Wheat, for flour	do	304,988 bushels	221	[4] 366,743.59	70,768.62	437,512.21
Total			1,171	1,071,363.34	140,330.65	1,211,693.99

[1] States ranked according to total volume of commodity expenditures.
[2] Includes $14,414.10 processing cost.
[3] Includes $337,338.10 processing cost.
[4] Includes $57,738.60 processing cost.

Exhibit 11.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., NOV. 18, 1935, THROUGH JUNE 30, 1936—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalent	Commodity	Transportation	Total
OHIO						
Apples, fresh	Section 32	15,727 bushels	26	$10,309.15	$2,897.96	$13,207.11
Milk, dry skim	Jones-Connally	40,050 pounds	1	3,013.36		3,013.36
Milk, evaporated	do	17,600 cases	22	40,144.00		40,144.00
Oat cereal, enriched	State	440,000 pounds	11	Exchange		Exchange
Oats, rolled	do	1,170,000 pounds	29	30,771.00		30,771.00
Onions	Section 32	111,500 pounds	4	669.00	166.72	835.72
Wheat, for flour	do	495,000 bushels	360	[5] 594,758.44	115,279.20	710,037.64
Total			453	679,664.95	118,343.88	798,008.83
GEORGIA						
Cotton, raw	Section 32	4,597 bales	92	235,695.33	15,387.92	251,083.25
Cotton fabric	do	2,507,324 yards	100	290,551.22	13,521.00	304,072.22
Cotton ticking	do	1,334,003 yards	27	144,725.93	3,791.34	148,517.27
Total			219	670,972.48	32,700.26	703,672.74
ILLINOIS						
Apples, fresh	State	97,578 bushels	163	65,128.15		65,128.15
Do	Section 32	27,447 bushels	46	19,104.15	5,127.16	24,231.31
Butter	Jones-Connally	1,851,774 pounds	96	513,543.15		513,543.15
Eggs, shell	Section 32	2,057 cases	5	13,381.20	253.15	13,634.35
Milk, evaporated	Jones-Connally	20,000 cases	25	42,886.00		42,886.00
Oats, rolled	State	530,000 pounds	13	12,720.00		12,720.00
Do	do	2,525,440 pounds	63	Exchange		Exchange
Total			411	666,762.65	5,380.31	672,142.96
IDAHO						
Apples, fresh	State	198,192 bushels	330	133,214.60		133,214.60
Do	Section 32	66,096 bushels	110	45,177.00	12,260.60	57,437.60
Beans, dried	State	750,000 pounds	15	20,780.00		20,780.00
Onions	Section 32	190,000 pounds	7	1,380.00	291.76	1,671.76
Peas, dried	State	10,490,880 pounds	175	183,439.05		183,439.05
Do	Section 32	3,420,780 pounds	57	59,413.50	21,399.19	80,812.69
Prunes, dried	do	142,000 pounds	2	4,768.50	907.76	5,676.26
Wheat, for flour	do	181,787 bushels	132	[6] 163,083.29	42,269.04	205,352.33
Total			828	611,255.94	77,128.35	688,384.29
MICHIGAN						
Apples, fresh	State	56,804 bushels	95	37,090.20		37,090.20
Do	Section 32	29,451 bushels	49	19,150.15	5,461.54	24,611.69
Beans, dried	State	11,650,000 pounds	231	242,550.00		242,550.00
Do	Section 32	1,200,000 pounds	24	25,200.00	7,370.00	32,570.00
Grapes	State	3,188,376 pounds	129	[7] 134,093.48		134,093.48
Milk, dry skim	Jones-Connally	80,100 pounds	2	6,082.23		6,082.23
Milk, evaporated	do	8,800 cases	11	20,072.00		20,072.00
Onions	Section 32	2,916,500 pounds	114	18,205.99	4,751.52	22,957.51
Sugar, beet	Jones-Costigan	2,300,000 pounds	39	102,076.89		102,076.89
Total			694	604,520.94	17,583.06	622,104.00
OREGON						
Apples, fresh	State	22,680 bushels	38	15,876.00		15,876.00
Do	Section 32	19,027 bushels	32	13,318.90	3,566.72	16,885.62
Butter	Jones-Connally	309,400 pounds	16	94,398.81		94,398.81
Cheese	do	124,630 pounds	5	19,790.32		19,790.32
Onions	Section 32	295,000 pounds	12	2,290.00	500.16	2,890.16
Prunes, dried	State	5,000,000 pounds	83	185,000.00		185,000.00
Do	Section 32	2,280,000 pounds	38	84,240.00	17,247.44	101,487.44
Wheat, for flour	do	150,109 bushels	109	[8] 140,328.02	34,903.98	175,232.00
Total			333	555,342.05	56,218.30	611,560.35

[5] Includes $93,710.60 processing cost.
[6] Includes $34,414.89 processing cost.
[7] Includes $84,536.30 processing cost.
[8] Includes $28,417.78 processing cost.

Exhibit 11.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., NOV. 18, 1935, THROUGH JUNE 30, 1936—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalent	Commodity	Transportation	Total
TENNESSEE						
Cotton, raw	Section 32	9,358 bales	187	$489,891.27	$31,277.62	$521,168.89
LOUISIANA						
Cabbage	do	144,000 pounds	6	935.95	927.36	1,863.31
Cotton, raw	do	1,366 bales	27	70,293.17	4,516.02	74,809.19
Cotton ticking	do	3,000,056 yards	60	313,505.82	8,425.20	321,931.02
Total			93	384,734.94	13,868.58	398,603.52
WISCONSIN						
Cheese	Jones-Connally	647,833 pounds	27	98,380.82		98,380.82
Cherries, canned	State	30,000 cans (#10)	1	10,000.00		10,000.00
Milk, dry skim	Jones-Connally	742,800 pounds	19	59,156.49		59,156.49
Milk, evaporated	do	84,800 cases	106	202,864.00		202,864.00
Total			153	370,401.31		370,401.31
VIRGINIA						
Apples, fresh	State	196,604 bushels	328	137,615.00		137,615.00
Do	Section 32	241,723 bushels	403	169,206.10	44,918.38	214,124.48
Total			731	306,821.10	44,918.38	351,739.48
MASSACHUSETTS						
Apples, fresh	Section 32	23,589 bushels	39	14,950.70	4,346.94	19,297.64
Cotton, raw	do	4,463 bales	89	239,835.58	14,886.14	254,721.72
Eggs, shell	do	1,200 cases	3	7,470.00	151.89	7,621.89
Onions	do	323,800 pounds	13	3,030.60	541.84	3,572.44
Turnips	State	182,300 pounds	7	727.20		727.20
Total			151	266,014.08	19,926.81	285,940.89
CONNECTICUT						
Apples, fresh	Section 32	9,913 bushels	16	7,815.60	1,783.36	9,598.96
Cotton mats	do	58,015 pieces	64	198,099.10	7,253.12	205,352.22
Total			80	205,914.70	9,036.48	214,951.18
ALABAMA						
Cabbage	Section 32	265,456 pounds	10	1,725.34	1,545.60	3,270.94
Cotton, raw	do	1,805 bales	36	96,734.51	6,021.36	102,755.87
Cotton ticking	do	415,982 yards	8	44,218.97	1,123.36	45,342.33
Total			54	142,678.82	8,690.32	151,369.14
PENNSYLVANIA						
Apples, fresh	State	60,022 bushels	100	42,015.40		42,015.40
Do	Section 32	113,924 bushels	190	79,746.80	21,177.40	100,924.20
Total			290	121,762.20	21,177.40	142,939.60
INDIANA						
Apples, fresh	State	958 bushels	1	622.70		622.70
Do	Section 32	1,558 bushels	3	1,012.70	334.38	1,347.08
Milk, evaporated	Jones-Connally	10,400 cases	13	23,776.00		23,776.00
Sugar, beet	Jones-Costigan	200,000 pounds	3	8,874.18		8,874.18
Wheat, for flour	Section 32	56,538 bushels	41	[1] 69,707.59	13,129.02	82,836.61
Total			61	103,993.17	13,463.40	117,456.57
MISSISSIPPI						
Cabbage	Section 32	8,288,417 pounds	319	53,866.62	49,304.64	103,171.26
Cotton, raw	do	312 bales	6	15,545.49	1,003.56	16,549.05
Total			325	69,412.11	50,308.20	119,720.31

[1] Includes $10,703.45 processing cost.

Exhibit 11.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., NOV. 18, 1935, THROUGH JUNE 30, 1936—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalent	Commodity	Transportation	Total
KENTUCKY						
Wheat, for flour	Section 32	55,000 bushels	40	[10] $67,994.01	$12,808.80	$80,802.81
NORTH CAROLINA						
Cotton, raw	do	200 bales	4	9,725.07	669.04	10,394.11
Cotton fabric	do	363,407 yards	15	57,089.37	2,028.15	59,117.52
Total			19	66,814.44	2,697.19	69,511.63
MISSOURI						
Apples, fresh	State	56,510 bushels	94	34,889.11		34,889.11
Do	Section 32	1,610 bushels	3	1,127.00	334.38	1,461.38
Cheese	Jones-Connally	87,906 pounds	4	13,845.35		13,845.35
Eggs, shell	Section 32	400 cases	1	2,280.00	50.63	2,330.63
Milk, evaporated	Jones-Connally	5,600 cases	7	13,440.00		13,440.00
Oats, rolled	State	2,420,601 pounds	60	Exchange		Exchange
Total			169	65,581.46	385.01	65,966.47
NEW JERSEY						
Apples, fresh	Section 32	14,917 bushels	25	11,170.80	2,786.50	13,957.30
Cotton, raw	do	653 bales	13	33,279.80	2,174.38	35,454.18
Total			38	44,450.60	4,960.88	49,411.48
SOUTH CAROLINA						
Cotton, raw	Section 32	832 bales	17	43,174.09	2,843.42	46,017.51
WEST VIRGINIA						
Apples, fresh	State	50,181 bushels	84	35,126.70		35,126.70
Do	Section 32	8,426 bushels	14	5,898.20	1,560.44	7,458.64
Total			98	41,024.90	1,560.44	42,585.34
MARYLAND						
Apples, fresh	State	35,153 bushels	58	24,607.10		24,607.10
Do	Section 32	2,703 bushels	5	1,872.10	557.30	2,429.40
Milk, dry skim	Jones-Connally	160,200 pounds	4	12,846.44		12,846.44
Total			67	39,325.64	557.30	39,882.94
MINNESOTA						
Milk, dry skim	Jones-Connally	341,100 pounds	8	26,620.28		26,620.28
Oat cereal, enriched	State	703,968 pounds	18	Exchange		Exchange
Oats, rolled	do	300,000 pounds	8	7,410.00		7,410.00
Do	do	2,429,845 pounds	61	Exchange		Exchange
Total			95	34,030.28		34,030.28
IOWA						
Oat cereal, enriched	State	1,749,690 pounds	44	Exchange		Exchange
Oats, rolled	do	1,000,000 pounds	25	23,800.00		23,800.00
Do	do	7,144,980 pounds	179	Exchange		Exchange
Total			248	23,800.00		23,800.00
MONTANA						
Apples, fresh	State	17,477 bushels	29	[11] 13,024.23		13,024.23
Beans, dried	do	220,000 pounds	4	6,180.00		6,180.00
Total			33	19,204.23		19,204.23

[10] Includes $10,412.30 processing cost.

[11] Includes $1,925.66 processing cost.

Exhibit 11.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., NOV. 18, 1935, THROUGH JUNE 30, 1936—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalent	Commodity	Transportation	Total
COLORADO						
Beans, dried	State	506,323 pounds	10	$13,668.15		$13,668.15
Onions	Section 32	75,000 pounds	3	644.75	$125.04	769.79
Total			13	14,312.90	125.04	14,437.94
OKLAHOMA						
Eggs, shell	Section 32	2,000 cases	5	11,400.00	253.15	11,653.15
FLORIDA						
Cotton, raw	do	49 bales	1	2,630.76	167.26	2,798.02
Grapefruit	do	9,782 boxes	16	7,533.96	5,133.12	12,667.08
Oranges	do	30 boxes	([12])	30.00		30.00
Total			17	10,194.72	5,300.38	15,495.10
ARIZONA						
Beans, dried	State	199,697 pounds	4	5,910.66		5,910.66
Grapefruit	Section 32	2,600 boxes	4	1,950.00	1,283.28	3,233.28
Onions	State	115,228 pounds	4	1,037.05		1,037.05
Total			12	8,897.71	1,283.28	10,180.99
UTAH						
Apples, fresh	State	11,763 bushels	20	8,229.80		8,229.80
Onions	Section 32	24,350 pounds	1	243.50	41.68	285.18
Total			21	8,473.30	41.68	8,514.98
ARKANSAS						
Cotton, raw	Section 32	101 bales	2	5,395.97	334.52	5,730.49
NEW MEXICO						
Beans, dried	State	100,000 pounds	2	3,230.00		3,230.00
NEW HAMPSHIRE						
Apples, fresh	Section 32	1,777 bushels	3	1,314.75	334.38	1,649.13
Total United States.			12,375	13,243,252.71	1,748,309.06	[13]14,991,561.77

[12] Less than carlot.

[13] Total expenditures by funds: State, $2,087,142.14; Jones Connally, $1,542,146.72; Jones-Costigan, $110,951.07; section 32, $11,251,321.84.

Exhibit 12.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, BY STATES, COMMODITIES, AND SOURCES OF FUNDS, JULY 1, 1936, THROUGH JUNE 30, 1937 [1]

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalents	Commodity	Transportation	Total
CALIFORNIA						
Apples, dried	State	600,000 pounds	9	$48,000.00		$48,000.00
Apples, fresh	do	12,498 bushels	20	8,949.92		8,949.92
Beans, dried	Section 32	1,200,000 pounds	20	32,100.00	$3,666.30	35,766.30
Eggs, shell	do	4,500 cases	11	31,464.00	604.78	32,068.78
Figs, dried	State	209,800 pounds	3	8,831.75		8,831.75
Milk, dry skim	Jones-Connally	4,800,672 pounds	121	341,232.95		341,232.95
Milk, evaporated	do	16,800 cases	21	43,224.00		43,224.00
Onions	Section 32	3,180,000 pounds	106	25,930.50	20,197.98	46,128.48
Peaches, dried	do	2,940,000 pounds	49	227,850.00	23,419.20	251,269.20
Pears, fresh	State	11,797 boxes	22	13,566.55		15,566.55
Do	Section 32	139,844 boxes	230	125,602.62	82,005.99	207,608.61
Potatoes, white	do	34,000 bushels	68	13,260.00	9,469.68	22,729.68
Prunes, dried	do	36,739,475 pounds	612	1,711,675.80	248,188.50	1,959,864.30
Walnuts, English	State	1,013,000 pounds	20	139,681.91		139,681.91
Total			1,312	2,771,370.00	387,552.43	3,158,922.43
NEW YORK						
Butter	State	36,525 pounds	1	11,505.37		11,505.37
Do	Jones-Connally	1,854,835 pounds	95	575,126.35		575,126.35
Eggs, shell	Section 32	190,465 cases	476	1,424,949.22	24,772.42	1,449,721.64
Fish, frozen	F. S. C. C.	195,202 pounds	6	9,122.35	1,567.14	10,689.49
Milk, dry skim	Jones-Connally	3,362,292 pounds	84	248,008.18		248,008.18
Milk, evaporated	Section 32	76,800 cases	96	188,928.00	11,655.36	200,583.36
Potatoes, white	do	12,657 bushels	20	8,489.80	2,785.20	11,275.00
Total			778	2,466,129.27	40,780.12	2,506,909.39
TEXAS						
Cattle	Section 32	1 head	(2)	17.40		17.40
Eggs, shell	do	2,000 cases	5	11,959.76	274.90	12,234.66
Grapefruit	do	1,199,296 boxes	2,977	683,569.19	811,024.11	1,494,593.30
Grapefruit juice	do	679,064 cases	423	850,912.47		850,912.47
Onions	do	9,129,000 pounds	358	105,111.00	67,253.88	172,364.88
Rice, milled	State	720,000 pounds	18	16,829.40		16,829.40
Total			3,781	1,668,399.22	878,552.89	2,546,952.11
WISCONSIN						
Cattle	Section 32	39 head	1	1,582.98	24.81	1,607.79
Fish, frozen	F. S. C. C.	30,150 pounds	1	2,035.13	261.19	2,296.32
Milk, dry skim	Jones-Connally	6,925,043 pounds	173	515,518.45		515,518.45
Milk, evaporated	do	140,200 cases	175	327,734.00		327,734.00
Total			350	846,870.56	286.00	847,156.56
ILLINOIS						
Butter	Jones-Connally	777,022 pounds	40	231,691.05		231,691.05
Cattle	Section 32	120 head	4	4,341.46	99.24	4,440.70
Eggs, shell	do	41,722 cases	104	278,557.16	5,291.08	283,848.24
Fish, frozen	F. S. C. C.	104,819 pounds	3	7,832.89	783.57	8,616.46
Milk, dry skim	Jones-Connally	719,988 pounds	18	57,185.51		57,185.51
Milk, evaporated	do	48,000 cases	60	108,000.00		108,000.00
Total			229	687,608.07	6,173.89	693,781.96

[1] States ranked according to total volume of commodity expenditures.
[2] Less than carlot.

Exhibit 12.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., JULY 1, 1936, THROUGH JUNE 30, 1937—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalents	Commodity	Transportation	Total
FLORIDA						
Celery	State	68,980 crates	197	$62,906.20		$62,906.20
Eggs, shell	Section 32	800 cases	2	6,240.00	$101.54	6,341.54
Fish, frozen	F. S. C. C.	166,200 pounds	5	7,513.01	1,305.95	8,818.96
Grapefruit	State	2,283 boxes	5	1,050.18		1,050.18
Do	Section 32	924,652 boxes	2,301	425,339.67	626,861.43	1,052,201.10
Grapefruit juice	do	36,006 cases	22	43,207.20		43,207.20
Sirup, cane	State	14,492 gallons	4	5,072.20		5,072.20
Do	Section 32	62,400 gallons	17	21,839.24	4,453.02	26,292.26
Total			2,553	573,167.70	632,721.94	1,205,889.64
MASSACHUSETTS						
Butter	Section 32	356,892 pounds	18	122,386.37	1,070.06	123,456.43
Eggs, shell	do	3,200 cases	8	24,531.00	439.64	24,970.84
Fish, frozen	State	237,781 pounds	8	11,037.69		11,037.69
Do	F. S. C. C.	8,210,875 pounds	273	398,328.29	71,304.87	469,633.16
Onions	Section 32	364,425 pounds	14	2,915.40	2,578.52	5,493.92
Turnips	State	1,388,365 pounds	53	6,941.67		6,941.67
Total			374	566,140.42	75,393.29	641,533.71
WASHINGTON						
Apples, dried	State	25,000 pounds	(1)	1,960.00		1,960.00
Eggs, shell	Section 32	8,672 cases	22	61,937.60	1,175.88	63,113.48
Fish, frozen	F. S. C. C.	1,507,597 pounds	52	73,231.75	13,581.88	86,813.63
Milk, dry skim	Jones-Connally	1,440,000 pounds	36	101,312.64		101,312.64
Milk, evaporated	do	8,000 cases	10	20,000.00		20,000.00
Pears, fresh	Section 32	94,838 boxes	156	75,870.40	49,749.60	125,620.00
Peas, dried	State	180,000 pounds	3	3,150.00		3,150.00
Do	Section 32	3,599,650 pounds	50	66,143.87	20,585.50	86,729.37
Peas, fresh green	State	1,653,572 pounds	99	52,959.20		52,959.20
Prunes, dried	Section 32	600,000 pounds	10	28,222.50	3,851.38	32,073.88
Wheat, for flour	do	7,074 bushels	5	[3] 7,408.36	2,867.27	10,275.63
Total			443	492,196.32	91,811.51	584,007.83
OHIO						
Cabbage	State	570,265 pounds	24	1,924.64		1,924.64
Eggs, shell	Section 32	2,000 cases	5	14,800.20	253.85	15,054.05
Fish, frozen	F. S. C. C.	765,724 pounds	26	48,880.21	6,790.94	55,671.15
Milk, dry skim	Jones-Connally	80,000 pounds	2	4,554.00		4,554.00
Milk, evaporated	State	4,000 cases	5	9,560.00		9,560.00
Do	Jones-Connally	89,600 cases	112	215,616.00		215,616.00
Oat cereal, enriched	F. S. C. C.	2,402,628 pounds	60	72,878.45	6,924.00	79,802.45
Total			234	368,213.50	13,968.79	382,182.29
NORTH CAROLINA						
Potatoes, white	Section 32	659,465 bushels	1,152	307,627.70	160,427.52	468,055.22
OREGON						
Cauliflower	do	30,500 crates	61	16,775.00	13,154.60	29,929.60
Eggs, shell	do	912 cases	2	6,429.60	109.96	8,539.56
Milk, dry skim	Jones-Connally	260,000 pounds	6	19,479.68		19,479.68
Prunes, dried	Section 32	5,600,000 pounds	89	245,032.50	32,877.08	277,909.58
Wheat, for flour	do	7,107 bushels	5	[3] 7,453.43	2,867.28	10,320.71
Total			163	295,170.21	49,008.92	344,179.13

[1] Less than carlot.

[3] Includes $1,618.70 processing cost.

Exhibit 12.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., JULY 1, 1936, THROUGH JUNE 30, 1937—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalents	Commodity	Transportation	Total
PENNSYLVANIA						
Cotton fabric	Section 32	1,052 yards	(1)	$315.60		$315.60
Eggs, shell	do	9,007 cases	23	66,129.21	$1,230.86	67,360.07
Fish, frozen	State	25,483 pounds	1	2,031.00		2,031.00
Do	F. S. C. C.	58,250 pounds	2	3,905.82	522.38	4,428.20
Milk, dry skim	Jones-Connally	320,000 pounds	8	24,583.68		24,583.68
Milk, evaporated	do	17,600 cases	22	44,528.00		44,528.00
Do	Section 32	23,200 cases	29	57,072.00	3,520.89	60,592.89
Potatoes, white	do	3,136 bushels	5	2,059.60	696.30	2,755.90
Total			90	200,624.91	5,970.43	206,595.34
IOWA						
Cattle	Section 32	210 head	7	6,269.41	173.67	6,443.08
Oat cereal, enriched	F. S. C. C.	3,232,274 pounds	81	98,043.94	9,347.40	107,391.34
Oats, rolled	State	2,526,300 pounds	63	78,234.36		78,234.36
Total			151	182,547.71	9,521.07	192,068.78
MICHIGAN						
Eggs, shell	Section 32	1,600 cases	4	10,680.00	219.92	10,899.92
Fish, frozen	F. S. C. C.	63,060 pounds	2	3,377.02	522.38	3,899.40
Milk, dry skim	Jones-Connally	1,560,604 pounds	39	112,588.84		112,588.84
Milk, evaporated	do	21,600 cases	27	51,336.00		51,336.00
Total			72	177,981.86	742.30	178,724.16
IDAHO						
Apples, dried	State	125,000 pounds	2	10,040.00		10,040.00
Milk, dry skim	Jones-Connally	1,359,684 pounds	34	98,838.45		98,838.45
Onions	Section 32	1,560,000 pounds	52	9,360.00	9,577.36	18,937.36
Peas, dried	State	420,000 pounds	7	7,350.00		7,350.00
Do	Section 32	2,399,820 pounds	40	44,396.85	16,468.40	60,865.25
Total			135	169,985.30	26,045.76	196,031.06
NEBRASKA						
Cattle	Section 32	223 head	7	6,959.06	173.67	7,132.73
Eggs, shell	do	2,000 cases	5	12,750.00	274.90	13,024.90
Milk, dry skim	Jones-Connally	1,519,597 pounds	38	118,667.81		118,667.81
Total			50	138,376.87	448.57	138,825.44
VIRGINIA						
Fish, frozen	F. S. C. C.	128,979 pounds	4	14,162.40	1,044.76	15,207.16
Potatoes, white	Section 32	224,855 bushels	396	104,714.50	55,146.96	159,861.46
Total			400	118,876.90	56,191.72	175,068.62
MARYLAND						
Cotton fabric	Section 32	523 yards	(1)	392.25		392.25
Eggs, shell	do	4,600 cases	12	33,450.00	634.50	34,084.50
Milk, dry skim	Jones-Connally	1,000,708 pounds	25	68,850.24		68,850.24
Milk, evaporated	do	1,600 cases	2	3,664.00		3,664.00
Total			39	106,356.49	634.50	106,990.99
LOUISIANA						
Rice, milled	State	1,799,980 pounds	45	44,647.52		44,647.52
Sirup, cane	do	3,810 gallons	1	1,333.50		1,333.50
Do	Section 32	133,893 gallons	37	46,862.55	656.37	47,518.92
Total			83	92,843.57	656.37	93,499.94

[1] Less than carlot.

Exhibit 12.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., JULY 1, 1936, THROUGH JUNE 30, 1937—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalents	Commodity	Transportation	Total
VERMONT						
Cheese	State	138,438 pounds	6	$24,697.55		$24,697.55
Milk, dry skim	Jones-Connally	520,000 pounds	13	41,289.84		41,289.84
Total			19	65,987.39		65,987.39
MINNESOTA						
Cattle	Section 32	143 head	5	4,190.49	$124.05	4,314.54
Fish, frozen	F. S. C. C	22,500 pounds	1	1,152.90	261.19	1,414.09
Milk, dry skim	Jones-Connally	920,280 pounds	23	60,154.93		60,154.93
Total			29	65,498.32	385.24	65,883.56
INDIANA						
Cattle	Section 32	8 head	[2]	240.86		240.86
Eggs, shell	do	5,600 cases	14	41,010.00	740.25	41,750.25
Milk, evaporated	State	4,000 cases	5	9,560.00		9,560.00
Total			19	50,810.86	740.25	51,551.11
MISSOURI						
Cattle	Section 32	53 head	2	1,139.10	49.62	1,188.72
Eggs, shell	do	800 cases	2	5,520.00	101.54	5,621.54
Fish, frozen	F. S. C. C	28,302 pounds	1	1,647.36	261.19	1,908.55
Milk, dry skim	Jones-Connally	120,107 pounds	3	7,134.38		7,134.38
Oats, rolled	State	1,107,000 pounds	28	34,281.53		34,281.53
Total			36	49,722.37	412.35	50,134.72
SOUTH DAKOTA						
Cattle	Section 32	623 head	21	15,758.68	521.01	16,279.69
Sheep	State	10,985 head	49	33,721.97		33,721.97
Total			70	49,480.65	521.01	50,001.66
TENNESSEE						
Cabbage	State	8,015,295 pounds	316	27,047.28		27,047.28
Milk, dry skim	Jones-Connally	200,000 pounds	5	16,380.00		16,380.00
Total			321	43,427.28		43,427.28
ARKANSAS						
Eggs, shell	Section 32	400 cases	1	2,419.92	54.98	2,474.90
Rice, milled	State	1,480,000 pounds	37	40,395.80		40,395.80
Total			38	42,815.72	54.98	42,870.70
DISTRICT OF COLUMBIA						
Cotton fabric	Section 32	1,000 yards	[2]	135.00		135.00
Eggs, shell	do	5,600 cases	7	40,490.63	334.77	40,825.40
Total			7	40,625.63	334.77	40,960.40
KENTUCKY						
Hogs	State	1,573 head	13	[4] 37,283.54		37,283.54

[2] Less than carlot.

[4] Includes $2,053.99 processing cost.

Exhibit 12.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., JULY 1, 1936, THROUGH JUNE 30, 1937—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalents	Commodity	Transportation	Total
COLORADO						
Apples, fresh	do	1,832 bushels	3	$568.69		$568.69
Beans, green	do	72,223 pounds	5	1,223.54		1,223.54
Beets, fresh	do	146,525 pounds	5	810.74		810.74
Carrots	do	35,190 pounds	1	257.31		257.31
Cattle	Section 32	15 head	1	465.20	$24.81	490.01
Cauliflower	do	48,170 crates	96	28,896.00	20,222.40	49,118.40
Chard, swiss	State	53,425 pounds	1	258.07		258.07
Corn, fresh	do	52,560 pounds	4	175.50		175.50
Peas, fresh	do	57,637 pounds	3	1,132.54		1,132.54
Spinach	do	32,358 pounds	1	194.16		194.16
Tomatoes, fresh	do	250,844 pounds	13	1,195.62		1,195.62
Total			133	35,177.37	20,247.21	55,424.58
NORTH DAKOTA						
Cattle	Section 32	1,431 head	48	33,530.38	1,190.88	34,721.26
GEORGIA						
Cotton fabric	Section 32	54,514 yards	2	5,741.27	251.51	5,992.78
Fish, frozen	F. S. C. C	50,000 pounds	2	2,000.00	522.38	2,522.38
Sirup, cane	State	19,022 gallons	5	6,657.53		6,657.53
Do	Section 32	45,000 gallons	13	15,750.03	244.53	15,994.56
Total			22	30,148.83	1,018.42	31,167.25
ALABAMA						
Pears, fresh	State	17,514 boxes	32	5,639.55		5,639.55
Potatoes, white	do	26,443 bushels	66	12,692.80		12,692.80
Sirup, cane	do	7,442 gallons	2	2,604.70		2,604.70
Do	Section 32	21,776 gallons	6	7,616.43	862.29	8,478.72
Total			106	28,553.48	862.29	29,415.77
MAINE						
Fish, frozen	State	25,380 pounds	1	1,469.35		1,469.35
Do	F. S. C. C	387,608 pounds	13	23,698.01	3,395.47	27,093.48
Total			14	25,167.36	3,395.47	28,562.83
MONTANA						
Cattle	Section 32	464 head	15	13,361.25	372.15	13,733.40
Sheep	State	1,520 head	7	4,666.13		4,666.13
Total			22	18,027.38	372.15	18,399.53
UTAH						
Eggs, shell	Section 32	1,368 cases	3	8,821.20	164.94	8,986.14
Milk, dry skim	Jones-Connally	40,000 pounds	1	3,267.00		3,267.00
Onions	Section 32	983,612 pounds	33	5,105.20	6,077.94	11,183.14
Total			37	17,193.40	6,242.88	23,436.28
WYOMING						
Cattle	Section 32	168 head	6	5,289.33	148.86	5,438.19
Sheep	State	1,664 head	7	5,108.18		5,108.18
Total			13	10,397.51	148.86	10,546.37
NEW JERSEY						
Fish, frozen	F. S. C. C	339,827 pounds	11	8,970.08	2,873.09	11,843.17

Exhibit 12.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., JULY 1, 1936, THROUGH JUNE 30, 1937—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalents	Commodity	Transportation	Total
KANSAS						
Cattle	Section 32	149 head	5	$2,793.56	$124.05	$2,917.61
Milk, dry skim	Jones-Connally	41,250 pounds	1	3,573.28		3,573.28
Total			6	6,366.84	124.05	6,490.89
RHODE ISLAND						
Eggs, shell	Section 32	800 cases	2	6,090.00	109.96	6,199.96
NEW HAMPSHIRE						
Eggs, shell	do	do	2	6,060.00	109.96	6,169.96
CONNECTICUT						
Eggs, shell	do	697 Cases	2	4,983.00	109.96	5,092.96
ARIZONA						
Beans, dried	State	100,637 pounds	2	4,275.48		4,275.48
Honey	do	2,940 pounds	(1)	147.00		147.00
Sirup, sorghum	do	200 gallons	(1)	100.00		100.00
Total			2	4,522.48		4,522.48
MISSISSIPPI						
Pears, fresh	State	3,804 boxes	7	1,225.00		1,225.00
OKLAHOMA						
Cattle	Section 32	16 head	(1)	225.29		225.00
Total United States			13,368	12,912,776.74	2,476,141.80	[2] 15,388,918.54

[1] Less than carload.
[2] Total expenditures by funds: Section 32, $10,222,375.95; Federal Surplus Commodities Corporation, $898,050.71; Jones-Connally, $3,463,539.26; State, $804,952.62.

Exhibit 13.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, BY STATES, COMMODITIES, AND SOURCES OF FUNDS, JULY 1, 1937, THROUGH MAY 6, 1938 [1]

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalents	Commodity	Transportation	Total
CALIFORNIA						
Apples, dried	Section 32	2,000,000 pounds	33	$126,876.50	$14,000.59	$140,877.09
Apples, fresh	do	170,204 bushels	213	89,460.00	25,173.20	114,633.20
Apricots, dried	State	600,000 pounds	10	45,000.00		45,000.00
Do	Section 32	2,990,000 pounds	50	224,250.00	17,720.73	241,970.73
Beans, dried	do	29,340,000 pounds	489	911,250.00	156,480.00	1,067,730.00
Butter	do	2,367,552 pounds	121	650,520.70	5,341.78	655,862.48
Eggs, shell	do	13,620 cases	29	87,147.44	1,729.60	88,877.04
Grapefruit	do	5,082 boxes	11	3,049.20	2,200.00	5,249.20
Milk, dry skim	do	660,000 pounds	11	37,420.20	3,404.42	40,806.62
Onions	do	3,000,000 pounds	100	24,000.00	23,510.27	47,510.27
Oranges	do	888,324 boxes	1,972	836,095.80	468,350.00	1,304,445.80
Peaches, dried	do	2,534,000 pounds	42	174,530.00	19,950.00	194,480.00
Pears, fresh	do	133,712 boxes	219	133,352.00	70,420.08	203,772.08
Potatoes, white	do	113,200 bushels	197	38,548.80	35,806.52	74,355.32
Prunes, dried	do	43,105,650 pounds	718	1,758,684.72	347,049.15	2,105,733.87
Rice, milled	do	3,200,000 pounds	64	56,300.00	15,046.21	71,346.21
Total			4,279	5,196,467.36	1,206,182.55	6,402,649.91
NEW YORK						
Apples, dried	Section 32	2,064,320 pounds	59	166,309.92	25,030.36	191,340.28
Apples, fresh	do	1,070,478 bushels	1,948	673,822.48	230,224.45	904,046.93
Beans, dried	do	3,300,000 pounds	66	114,425.00	21,120.00	135,545.00
Butter	do	2,629,768 pounds	138	780,896.54	6,092.28	786,988.82
Eggs, shell	do	49,037 cases	123	291,801.18	7,335.89	299,137.07
Grapes	F. S. C. C.	834,000 pounds	33	11,476.50	5,637.62	17,114.12
Milk, dry skim	Section 32	1,361,700 pounds	34	68,485.50	10,522.75	79,008.25
Pears, fresh	do	41,443 boxes	58	72,525.25		72,525.25
Do	F. S. C. C.	11,483 boxes	15	20,095.25		20,095.25
Potatoes, white	Section 32	67,000 bushels	134	32,160.00	24,355.70	56,515.70
Total			2,608	2,231,997.62	330,319.05	2,562,316.67
WASHINGTON						
Apples, dried	Section 32	8,357,700 pounds	141	722,188.25	59,820.68	782,008.93
Apples, fresh	do	773,528 bushels	1,011	443,108.04	119,484.03	562,592.07
Butter	do	164,560 pounds	9	44,118.40	397.32	44,515.72
Eggs, shell	do	12,312 cases	27	78,535.50	1,610.32	80,145.82
Milk, dry skim	do	48,000 pounds	8	27,201.60	2,475.94	29,677.54
Pears, fresh	do	91,418 boxes	149	81,422.70	48,485.23	129,907.93
Do	F. S. C. C.	1,800 boxes	2	1,800.00	668.80	2,468.80
Peas, canned	do	45,544 cases	45	67,615.41	7,287.04	74,902.45
Peas, dried	Section 32	3,960,000 pounds	66	58,050.00	25,746.60	83,796.60
Prunes, dried	do	1,000,000 pounds	17	42,155.61	8,217.04	50,372.65
Total			1,475	1,566,195.51	274,193.00	1,840,388.51
ILLINOIS						
Apples, fresh	Section 32	41,387 bushels	79	27,365.05	9,336.54	36,701.59
Butter	do	3,941,788 pounds	205	1,094,845.39	9,050.12	1,103,895.51
Eggs, shell	do	43,662 cases	111	274,646.59	6,620.19	281,266.78
Milk, dry skim	do	280,000 pounds	7	15,867.60	2,166.45	18,034.05
Pears, fresh	do	8,250 boxes	11	13,612.50		13,612.50
Total			415	1,426,337.13	27,173.30	1,453,510.43
IDAHO						
Apples, dried	Section 32	2,100,000 pounds	35	192,150.00	14,849.11	206,999.11
Apples, fresh	do	388,816 bushels	592	211,568.70	69,964.93	281,533.63
Beans, dried	do	10,440,000 pounds	174	274,320.00	55,680.00	330,000.00
Milk, dry skim	do	540,000 pounds	9	30,601.80	2,785.43	33,387.23
Peas, dried	do	2,040,000 pounds	34	31,200.00	13,263.40	44,463.40
Potato flour	do	1,681,680 pounds	42	63,063.00	16,884.00	79,947.00
Potatoes, white	do	1,431,961 bushels	2,385	492,907.97	433,495.16	926,403.13
Total			3,271	1,295,811.47	606,922.03	1,902,733.50

[1] States ranked according to total volume of commodity expenditure.

Exhibit 13.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., JULY 1, 1937, THROUGH MAY 6, 1938—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalents	Commodity	Transportation	Total
LOUISIANA						
Cabbage	Section 32	734,315 pounds	30	$3,304.42	$4,500.00	$7,804.42
Cotton fabric	do	7,290 yards	(2)	1,166.40		1,166.40
Cottonseed oil, short	F. S. C. C.	4,432,200 pounds	166	378,413.64	22,889.54	401,303.18
Rice, milled	Section 32	28,960,000 pounds	579	664,785.00	136,121.23	800,906.23
Total			775	1,047,669.46	163,510.77	1,211,180.23
MICHIGAN						
Apples, fresh	Section 32	626,161 bushels	1,175	380,256.75	138,867.20	519,123.95
Beans, dried	do	7,000,000 pounds	140	200,100.00	44,800.00	244,900.00
Eggs, shell	do	4,399 cases	11	28,384.31	656.06	29,040.37
Grapes	F. S. C. C.	9,650,000 pounds	402	134,729.59	68,676.43	203,406.02
Milk, dry skim	Section 32	720,100 pounds	18	38,433.05	5,570.87	44,003.92
Peas, canned	F. S. C. C.	74,400 cases	74	109,746.43	11,904.00	121,650.43
Potato flour	Section 32	80,040 pounds	2	3,501.60	804.00	4,305.60
Potatoes, white	do	107,443 bushels	179	54,362.65	32,534.86	86,897.51
Total			2,001	949,514.38	303,813.42	1,253,327.80
WISCONSIN						
Eggs, shell	Section 32	7,200 cases	18	45,627.08	1,073.55	46,700.63
Milk, dry skim	do	2,240,000 pounds	56	119,195.60	17,331.57	136,527.17
Peas, canned	F. S. C. C.	537,389 cases	537	780,237.58	85,982.24	866,219.82
Potatoes, white	Section 32	7,923 bushels	13	3,320.40	2,362.87	5,683.27
Total			624	948,380.66	106,750.23	1,055,130.89
VIRGINIA						
Apples, fresh	Section 32	823,219 bushels	1,351	507,701.39	159,667.59	667,368.98
Peas, canned	F. S. C. C.	61,000 cases	61	61,993.24	9,760.00	71,753.24
Potatoes, sweet	Section 32	336,436 bushels	509	96,590.18	51,629.17	148,210.35
Potatoes, white	do	395,061 bushels	647	181,042.50	117,598.05	298,640.55
Total			2,568	847,327.31	338,645.81	1,185,973.12
ARKANSAS						
Apples, fresh	Section 32	87,656 bushels	168	52,593.60	19,854.92	72,448.52
Eggs, shell	do	4,400 cases	11	23,630.96	656.06	24,287.02
Rice, milled	do	23,700,000 pounds	474	559,673.00	111,436.03	671,109.03
Total			653	635,897.56	131,947.01	767,844.57
FLORIDA						
Celery	Section 32	184,475 crates	501	185,416.25	138,356.25	323,772.50
Oranges	do	769,990 boxes	2,043	449,628.50	508,963.00	958,591.50
Total			2,644	635,044.75	647,319.25	1,282,364.00
TEXAS						
Cottonseed oil, short	F. S. C. C.	534,000 pounds	20	46,977.87	2,757.78	49,735.65
Eggs, shell	Section 32	14,900 cases	37	78,948.51	2,206.73	81,155.24
Rice, milled	do	16,770,000 pounds	335	383,420.50	78,757.53	462,178.03
Total			392	509,346.88	83,722.04	593,068.92
NEW JERSEY						
Apples, fresh	Section 32	38,264 bushels	69	23,569.10	8,154.70	31,723.80
Eggs, shell	do	49,356 cases	124	318,191.04	7,395.53	325,586.57
Peas, canned	F. S. C. C.	7,281 cases	7	8,855.75	1,164.96	10,020.71
Potatoes, sweet	Section 32	27,000 bushels	45	16,200.00	4,563.67	20,763.67
Potatoes, white	do	164,500 bushels	329	78,960.00	59,798.70	138,758.70
Total			574	445,775.89	81,077.56	526,853.45

[2] Less than carlot.

Exhibit 13.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., JULY 1, 1937, THROUGH MAY 6, 1938—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalents	Commodity	Transportation	Total
OHIO						
Apples, fresh	Section 32	511,315 bushels	954	$317,668.67	$112,747.54	$430,416.21
Eggs, shell	do	12,000 cases	30	77,417.23	1,789.24	79,206.47
Grapes	F. S. C. C.	1,262,000 pounds	49	16,630.50	8,371.00	25,001.50
Peas, canned	do	9,258 cases	9	13,073.78	1,481.28	14,558.06
Total			1,042	424,793.18	124,389.06	549,182.24
MARYLAND						
Apples, fresh	Section 32	90,460 bushels	153	53,034.46	18,082.16	71,116.62
Cotton fabric	do	90,663 yards	(1)	14,269.74		14,269.74
Cottonseed oil, short	F. S. C. C.	694,200 pounds	25	60,290.69	3,447.22	63,737.91
Eggs, shell	Section 32	1,600 cases	4	10,510.96	238.57	10,749.53
Milk, dry skim	do	640,000 pounds	16	30,400.00	4,951.88	35,351.88
Peas, canned	F. S. C. C.	96,032 cases	96	127,602.01	15,365.12	142,967.13
Potatoes, sweet	Section 32	14,168 bushels	22	4,705.22	2,231.13	6,936.35
Potatoes, white	do	37,563 bushels	61	17,178.00	11,087.30	28,265.30
Total			377	317,991.08	55,403.38	373,394.46
NEW HAMPSHIRE						
Apples, fresh	Section 32	12,517 bushels	21	5,079.90	2,481.87	7,561.77
Milk, fluid	F. S. C. C.	4,341,012 quarts	(1)	308,011.12		308,011.12
Total			21	313,091.02	2,481.87	315,572.89
VERMONT						
Apples, fresh	Section 32	32,237 bushels	56	15,415.55	6,618.31	22,033.86
Milk, fluid	F. S. C. C.	4,207,164 quarts	(1)	294,635.31		294,635.31
Total			56	310,050.86	6,618.31	316,669.17
PENNSYLVANIA						
Apples, fresh	Section 32	325,840 bushels	545	212,039.34	64,410.28	276,449.62
Eggs, shell	do	2,000 cases	5	13,138.70	298.21	13,436.91
Grapes	F. S. C. C.	4,084,000 pounds	163	56,170.64	27,846.38	84,017.02
Milk, dry skim	Section 32	280,000 pounds	7	15,867.60	2,166.45	18,034.05
Peas, canned	F. S. C. C.	1,000 cases	1	1,666.28	160.00	1,826.28
Total			721	298,882.56	94,881.32	393,763.88
INDIANA						
Apples, fresh	Section 32	50,123 bushels	97	31,841.30	11,465.85	43,305.15
Eggs, shell	do	2,000 cases	5	13,138.70	298.21	13,436.91
Milk, dry skim	do	120,000 pounds	3	6,800.40	928.48	7,728.88
Peas, canned	F. S. C. C.	16,410 cases	16	187,182.20	2,625.60	189,807.60
Total			121	238,962.60	15,316.14	254,278.74
MINNESOTA						
Eggs, shell	Section 32	4,000 cases	10	26,277.40	596.41	26,873.81
Milk, dry skim	do	760,450 pounds	19	38,888.25	5,880.36	44,768.61
Peas, canned	F. S. C. C.	4,450 cases	4	6,748.96	712.00	7,460.96
Potatoes, white	Section 32	435,213 bushels	725	145,209.30	131,775.25	276,984.55
Total			758	217,123.91	138,964.02	356,087.93
TENNESSEE						
Cottonseed oil, short	F. S. C. C.	1,602,000 pounds	60	135,913.99	8,273.33	144,187.32
Eggs, shell	Section 32	10,800 cases	27	70,948.99	1,610.32	72,559.31
Total			87	206,862.98	9,883.65	216,746.63

[1] Less than carlot.

Exhibit 13.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., JULY 1, 1937, THROUGH MAY 6, 1938—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalents	Commodity	Transportation	Total
GEORGIA						
Cotton fabric	Section 32	308,521 yards	(2)	$33,601.95		$33,601.95
Cottonseed oil, short	F. S. C. C.	1,441,800 pounds	54	124,244.83	$7,446.00	131,690.83
Eggs, shell	Section 32	3,600 cases	9	23,649.66	536.77	24,186.43
Watermelons	State	13,545 melons	16	577.89		577.89
Total			79	182,074.33	7,982.77	190,057.10
OREGON						
Butter	Section 32	98,800 pounds	5	27,489.00	220.73	27,709.73
Eggs, shell	do	3,299 cases	7	21,065.45	417.49	21,482.94
Filberts	State	500 pounds	(2)	65.00		65.00
Milk, dry skim	Section 32	160,000 pounds	3	8,600.40	928.48	9,528.88
Pears, fresh	do	28,076 boxes	38	28,076.00	9,913.04	37,989.04
Do	State	180 boxes	(2)	288.00		288.00
Do	F. S. C. C.	1,800 boxes	3	1,800.00	1,003.20	2,803.20
Potatoes, white	Section 32	127,200 bushels	211	40,213.80	38,351.14	78,564.94
Prunes, dried	do	1,000,000 pounds	16	42,155.60	7,733.69	49,889.29
Walnuts, English	State	1,000 pounds	(2)	115.00		115.00
Total			283	169,868.25	58,567.77	228,436.02
MAINE						
Apples, fresh	Section 32	11,939 bushels	20	4,534.60	2,363.68	6,898.28
Potato starch	do	800,000 pounds	20	36,000.00	3,870.00	39,870.00
Potatoes, white	do	302,667 bushels	454	113,930.02	82,518.57	196,448.59
Total			494	154,464.62	88,752.25	243,216.87
NORTH DAKOTA						
Potatoes, white	Section 32	440,133 bushels	734	149,393.35	133,411.08	282,804.43
WEST VIRGINIA						
Apples, dried	do	45,480 pounds	1	3,683.88	424.26	4,108.14
Apples, fresh	do	238,802 bushels	395	135,271.44	46,682.68	181,954.12
Total			396	138,955.32	47,106.94	186,062.26
NEBRASKA						
Beans, dried	Section 32	540,000 pounds	9	15,090.00	2,880.00	17,970.00
Eggs, shell	do	8,000 cases	20	52,554.80	1,192.83	53,747.63
Milk, dry skim	do	120,000 pounds	3	5,400.00	928.48	6,328.48
Potatoes, white	do	181,797 bushels	303	58,263.15	55,072.97	113,336.12
Total			335	131,307.95	60,074.28	191,382.23
UTAH						
Apples, fresh	Section 32	20,029 bushels	28	10,539.75	3,309.15	13,848.90
Eggs, shell	do	1,800 cases	3	11,824.80	178.92	12,003.72
Milk, dry skim	do	40,000 pounds	1	1,912.00	309.48	2,221.48
Peas, canned	F. S. C. C.	2,500 cases	2	3,915.71	400.00	4,315.71
Potatoes, white	Section 32	41,677 bushels	70	14,737.00	12,723.13	27,460.13
Tomatoes, canned	F. S. C. C.	50,000 cases	40	87,500.00	14,651.95	102,151.95
Total			144	130,429.26	31,572.63	162,001.89
MISSOURI						
Apples, fresh	Section 32	55,366 bushels	105	33,433.80	12,409.32	45,843.12
Eggs, shell	do	12,179 cases	31	73,053.45	1,848.88	74,902.33
Milk, dry skim	do	240,000 pounds	6	13,600.80	1,856.96	15,457.76
Total			142	120,088.05	16,115.16	136,203.21

[2] Less than carlot.

Exhibit 13.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., JULY 1, 1937, THROUGH MAY 6, 1938—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalents	Commodity	Transportation	Total
ARIZONA						
Grapefruit	Section 32	206,820 boxes	417	$112,168.38	$83,400.00	$195,568.38
Oranges	do	3,000 boxes	5	1,818.00	1,188.00	3,006.00
Total			422	113,986.38	84,588.00	198,574.38
COLORADO						
Apples, fresh	Section 32	1,290 bushels	2	774.00	236.37	1,010.37
Beans, fresh green	State	44,970 pounds	3	562.12		562.12
Cabbage	do	100,120 pounds	4	250.30		250.30
Eggs, shell	Section 32	4,000 cases	10	26,020.13	596.41	26,616.54
Potatoes, white	do	233,737 bushels	390	82,748.35	70,886.00	153,634.35
Total			409	110,354.90	71,718.78	182,073.68
WYOMING						
Beans, dried	Section 32	2,460,000 pounds	41	67,650.00	13,120.00	80,770.00
Peas, canned	F. S. C. C.	2,000 cases	2	2,832.57	320.00	3,152.57
Potatoes, white	Section 32	32,400 bushels	54	10,836.00	9,814.98	20,650.98
Total			97	81,318.57	23,254.98	104,573.55
DELAWARE						
Apples, fresh	Section 32	51,754 bushels	95	31,663.35	11,227.48	42,890.85
Peas, canned	F. S. C. C.	1,000 cases	1	1,666.28	160.00	1,826.28
Potatoes, sweet	Section 32	62,700 bushels	121	31,350.00	12,271.20	43,621.20
Total			217	64,679.63	23,658.68	88,338.31
MISSISSIPPI						
Cabbage	Section 32	9,168,325 pounds	397	62,629.56	59,550.00	122,179.56
NORTH CAROLINA						
Apples, fresh	do	7,277 bushels	12	2,095.78	1,418.21	3,513.99
Cabbage	do	3,548,827 pounds	140	16,902.97	21,000.00	37,902.97
Cotton fabric	do	94,876 yards	(2)	9,137.30		9,137.30
Potatoes, sweet	State	42,232 bushels	70	19,544.40		19,544.40
Potatoes, white	Section 32	12,586 bushels	21	5,790.00	3,816.94	9,606.94
Total			243	53,470.45	26,235.15	79,705.60
MONTANA						
Apples, fresh	Section 32	38,205 bushels	50	20,941.20	5,909.20	26,850.40
Beans, dried	do	60,000 pounds	1	1,530.00	320.00	1,850.00
Peas, canned	F. S. C. C.	1,948 cases	2	2,330.36	311.68	2,642.04
Potatoes, white	Section 32	78,000 bushels	130	26,280.00	23,628.67	49,908.67
Do	State	3,992 bushels	7	1,765.50		1,765.50
Total			190	52,847.06	30,169.55	83,016.61
OKLAHOMA						
Apples, fresh	Section 32	54,897 bushels	73	30,370.00	8,627.43	38,997.43
Potatoes, white	do	26,420 bushels	66	11,889.00	11,996.09	23,885.09
Total			139	42,259.00	20,623.52	62,882.52
MASSACHUSETTS						
Apples, fresh	Section 32	73,958 bushels	130	32,686.30	15,363.92	48,050.22
KANSAS						
Eggs, shell	do	3,200 cases	8	20,636.02	477.13	21,113.15
Potatoes, white	do	14,152 bushels	27	6,368.25	4,907.49	11,275.74
Total			35	27,004.27	5,384.62	32,388.89

[2] Less than carlot.

Exhibit 13.—PURCHASES BY THE FEDERAL SURPLUS COMMODITIES CORPORATION, ETC., JULY 1, 1937, THROUGH MAY 6, 1938—Continued

State and commodity purchased	Source of funds	Quantity purchased		Expenditure		
		Commercial units	Carlot equivalents	Commodity	Transportation	Total
SOUTH CAROLINA						
Cabbage	Section 32	4,222,677 pounds	198	$25,080.91	$29,700.00	$54,780.91
Cotton fabric	do	4,392 yards	(2)	389.50		389.50
Watermelons	State	320 melons	(2)	20.80		20.80
Total			198	25,491.21	29,700.00	55,191.21
ALABAMA						
Cabbage	Section 32	1,278,500 pounds	47	7,463.75	7,050.00	14,513.75
Cotton fabric	do	120,359 yards	(2)	6,920.80		6,920.80
Total			47	14,384.55	7,050.00	21,434.55
CONNECTICUT						
Apples, fresh	Section 32	22,719 bushels	38	10,615.60	4,490.99	15,106.59
Cotton fabric	do	20,363 yards	(2)	1,374.45		1,374.45
Total			38	11,990.05	4,490.99	16,481.04
IOWA						
Eggs, shell	Section 32	1,600 cases	4	9,996.43	238.57	10,235.00
DISTRICT OF COLUMBIA						
Cotton fabric	do	9,533 yards	(2)	1,030.80		1,030.80
Eggs, shell	do	1,200 cases	3	7,883.22	178.92	8,062.14
Total			3	8,914.02	178.92	9,092.94
NEVADA						
Potatoes, white	Section 32	25,200 bushels	42	7,560.00	7,633.88	15,193.88
KENTUCKY						
Apples, fresh	do	6,196 bushels	13	4,647.00	1,536.39	6,183.39
Total, United States			30,691	21,964,324.68	5,604,472.60	[3] 27,568,797.28

[2] Less than carlot.

[3] Total expenditures by funds: Section 32, $24,137,145.61; Federal Surplus Commodities Corporation $3,363,462.66; State, $68,189.01.

Appendix E.—DISBURSEMENTS BY THE AGRICULTURAL ADJUSTMENT ADMINISTRATION, JANUARY 1, 1937, THROUGH JUNE 30, 1938, BY STATES, COMMODITIES, AND OBJECTIVES

Exhibit 14.—AGRICULTURAL CONSERVATION PAYMENTS JAN. 1, 1937, THROUGH JUNE 30, 1938

1936 PROGRAM

	Total	Performance payments	County associations	Naval stores
Southern Region:				
South Carolina	$7,356,317.03	$7,346,933.85		$9,383.18
Georgia	9,651,833.01	9,538,910.10		112,922.91
Florida	1,076,124.65	1,019,035.77		57,088.88
Alabama	9,801,527.81	9,801,477.81		50.00
Mississippi	10,161,361.68	10,161,361.68		
Arkansas	10,133,354.79	10,133,354.79		
Louisiana	6,677,762.87	6,677,762.87		
Oklahoma	13,737,394.92	13,737,394.92		
Texas	34,799,111.79	34,799,111.79		
Total	103,394,788.55	103,215,343.58		179,444.97
East Central Region:				
Maryland	1,308,684.58	1,299,854.18	$8,830.40	
Delaware	169,926.20	167,454.70	2,471.50	
Virginia	3,059,187.62	3,031,346.82	27,840.80	
West Virginia	590,545.11	576,105.63	14,439.48	
North Carolina	11,681,941.26	11,579,376.89	102,564.37	
Kentucky	10,020,658.80	9,956,275.72	64,383.08	
Tennessee	7,824,960.71	7,764,784.22	60,176.49	
Total	34,655,904.28	34,375,198.16	280,706.12	
Northeast Region:				
Maine	117,771.07	117,771.07		
New Hampshire	43,212.23	43,212.23		
Vermont	112,850.38	112,850.38		
Massachusetts	70,100.32	70,100.32		
Rhode Island	8,868.06	8,868.06		
Connecticut	274,000.45	274,000.45		
New York	1,257,660.96	1,257,660.96		
New Jersey	77,657.56	77,657.56		
Pennsylvania	1,248,764.42	1,248,764.42		
Total	3,210,885.45	3,210,885.45		
North Central Region:				
Ohio	8,112,080.04	7,344,008.28	768,071.76	
Indiana	8,968,762.68	8,718,204.33	250,558.35	
Illinois	14,293,448.44	13,901,786.41	391,662.03	
Michigan	6,367,127.42	5,919,083.32	448,044.10	
Wisconsin	10,067,234.53	9,710,165.86	357,068.67	
Minnesota	16,437,794.74	16,254,003.49	183,791.25	
Iowa	23,651,828.67	23,338,553.16	313,275.51	
Missouri	12,227,801.08	11,666,597.33	561,203.75	
South Dakota	13,891,418.16	13,717,298.41	174,119.75	
Nebraska	13,985,592.33	13,656,308.63	329,283.70	
Total	128,003,088.09	124,226,009.22	3,777,078.87	
Western Region:				
North Dakota	18,296,342.74	18,134,219.74	162,123.00	
Kansas	16,156,828.18	15,786,176.25	370,651.93	
Montana	6,527,205.51	6,401,556.95	125,648.56	
Idaho	2,689,477.99	2,583,691.82	105,786.17	
Wyoming	1,066,958.11	1,040,316.37	26,641.74	
Colorado	4,219,489.68	4,124,691.10	94,798.58	
New Mexico	2,651,662.85	2,599,971.38	51,691.47	
Arizona	1,046,687.01	1,036,826.13	9,860.88	
Utah	758,407.91	734,091.11	24,316.80	
Nevada	125,242.46	124,552.90	689.56	
Washington	2,368,268.94	2,329,186.02	39,082.92	
Oregon	1,851,303.60	1,817,305.35	33,998.25	
California	4,196,269.75	4,040,438.12	155,831.63	
Total	61,954,144.73	60,753,023.24	1,201,121.49	

Exhibit 14.—AGRICULTURAL CONSERVATION PAYMENTS JAN. 1, 1937, THROUGH JUNE 30, 1938—Continued

1936 PROGRAM—Continued

	Total	Performance payments	County associations	Naval stores
Insular Region:				
Alaska	$1,005.00	$1,005.00		
Hawaii	577,288.47	577,288.47		
Puerto Rico	993,344.06	993,344.06		
Total	1,571,637.53	1,571,637.53		
Undistributed	—(49,983.12)	—(49,983.12)		
Grand total	$332,740,465.51	$327,302,114.06	$5,258,906.48	$179,444.97

1937 PROGRAM

	Total	Performance payments	County associations	Grants of aid	Preliminary performance payments	Naval stores
Southern Region:						
South Carolina	$4,951,897.10	$4,643,898.30	$299,267.64			$8,731.16
Georgia	4,723,907.17	4,068,888.67	473,647.86			181,370.64
Florida	1,380,150.30	1,117,576.02	119,226.34			143,347.94
Alabama	4,139,879.31	3,633,334.55	484,877.96			21,666.80
Mississippi	8,513,125.32	8,133,667.77	377,688.34			1,769.21
Arkansas	8,611,847.02	8,237,042.55	374,804.47			
Louisiana	4,655,623.75	4,334,355.24	319,803.46			1,462.05
Oklahoma	11,581,297.22	10,755,266.59	555,240.74		$270,789.89	
Texas	31,782,640.06	30,626,238.74	1,016,807.75		138,366.13	1,227.44
Total	80,340,367.25	75,550,271.43	4,021,364.56		409,156.02	359,575.24
East Central Region:						
Maryland	1,244,261.99	1,146,132.57	98,129.42			
Delaware	463,143.77	435,673.50	27,470.27			
Virginia	2,640,187.27	2,282,007.00	341,469.92	$16,710.35		
West Virginia	1,044,128.42	839,837.93	203,014.08	1,276.41		
North Carolina	8,356,454.52	7,689,782.52	654,739.78	11,932.52		
Kentucky	10,375,312.59	9,095,766.00	681,151.99	598,394.60		
Tennessee	6,615,655.26	5,951,985.58	495,851.47	167,818.21		
Total	30,739,144.12	27,441,185.10	2,501,826.93	796,132.09		
Northeast Region:						
Maine	841,652.92	752,663.29	88,989.63			
New Hampshire	194,434.55	166,550.17	27,884.38			
Vermont	445,959.97	409,481.29	36,478.68			
Massachusetts	365,218.19	324,502.02	40,716.17			
Rhode Island	25,121.50	22,146.14	2,975.36			
Connecticut	336,942.93	305,255.54	31,687.39			
New York	3,814,230.34	3,537,356.85	276,873.49			
New Jersey	916,791.66	831,320.32	85,471.34			
Pennsylvania	3,295,742.97	2,922,485.10	373,257.87			
Total	10,236,095.03	9,271,760.72	964,334.31			
North Central Region:						
Ohio	5,341,100.44	4,165,560.70	1,175,539.74			
Indiana	5,631,418.77	4,605,971.75	1,025,447.02			
Illinois	8,065,580.77	6,732,665.86	1,332,914.91			
Michigan	5,513,638.86	4,616,960.72	896,678.14			
Wisconsin	7,629,089.87	6,598,901.71	1,030,188.16			
Minnesota	12,355,412.44	11,157,283.65	1,198,128.79			
Iowa	16,399,838.92	14,833,287.95	1,566,550.97			
Missouri	7,602,357.37	6,119,933.63	1,482,423.74			
South Dakota	13,025,265.81	12,105,407.06	919,858.75			
Nebraska	10,692,366.56	9,520,063.70	1,172,302.86			
Total	92,256,069.81	80,456,036.73	11,800,033.08			

Exhibit 14.—AGRICULTURAL CONSERVATION PAYMENTS JAN. 1, 1937, THROUGH JUNE 30, 1938—Continued

1937 PROGRAM—Continued

	Total	Performance payments	County associations	Grants of aid	Preliminary performance payments	Naval stores
Western Region:						
North Dakota	$13,141,668.61	$11,940,672.73	$1,200,995.88			
Kansas	14,760,987.15	13,497,567.98	981,052.74		$282,366.43	
Montana	6,964,577.91	6,444,594.24	519,983.67			
Idaho	1,587,191.83	1,236,337.15	350,854.68			
Wyoming	1,481,955.75	1,281,392.18	200,563.57			
Colorado	3,681,905.62	3,240,471.89	373,709.84		67,723.89	
New Mexico	2,391,025.58	2,106,192.56	249,291.34		35,541.68	
Arizona	1,085,112.50	987,835.09	97,277.41			
Utah	732,067.83	603,010.90	129,056.93			
Nevada	157,264.61	92,476.23	64,788.38			
Washington	1,776,534.11	1,545,997.80	230,536.31			
Oregon	2,341,894.68	2,064,355.60	277,539.08			
California	5,378,391.33	4,673,283.94	705,107.39			
Total	55,480,577.51	49,714,188.29	5,380,757.22		385,632.00	
Insular Region:						
Alaska	2,296.49	2,296.49				
Hawaii	616,819.04	616,819.04				
Total	619,115.53	619,115.53				
Grand total	269,671,369.25	243,052,557.80	24,668,316.10	$796,132.09	794,788.02	$359,575.24

1938 PROGRAM

	Total	County associations	Grants of aid
Southern Region:			
South Carolina	$100,184.59	$100,184.59	
Georgia	201,274.28	201,274.28	
Florida	34,391.76	34,391.76	
Alabama	165,005.19	165,005.19	
Mississippi	128,425.09	128,425.09	
Arkansas	120,670.49	120,670.49	
Louisiana	90,537.67	90,537.67	
Oklahoma	151,297.32	151,297.32	
Texas	251,774.24	251,774.24	
Total	1,243,560.63	1,243,560.63	
East Central Region:			
Maryland	25,459.17	25,459.17	
Delaware	4,428.85	4,428.85	
Virginia	78,196.34	78,196.34	
West Virginia	42,070.43	42,070.43	
North Carolina	236,129.16	236,129.16	
Kentucky	183,494.76	181,832.64	$1,662.12
Tennessee	123,834.73	123,834.73	
Total	693,613.44	691,951.32	1,662.12
Northeast Region:			
Maine	9,952.89	9,625.54	327.35
New Hampshire	5,427.37	5,427.37	
Vermont	8,716.14	8,716.14	
Massachusetts	6,323.84	6,323.84	
Rhode Island	1,242.06	1,242.06	
Connecticut	6,214.53	6,214.53	
New York	83,378.24	83,378.24	
New Jersey	29,270.28	29,270.28	
Pennsylvania	85,777.39	85,777.39	
Total	236,302.74	235,975.39	327.35

Exhibit 14.—AGRICULTURAL CONSERVATION PAYMENTS JAN. 1, 1937, THROUGH JUNE 30, 1938—Continued

1938 PROGRAM—Continued

	Total	County associations	Grants of aid
North Central Region:			
Ohio	$280,483.77	$280,483.77	
Indiana	281,944.59	281,944.59	
Illinois	405,074.28	405,074.28	
Michigan	185,808.94	185,808.94	
Wisconsin	218,541.17	218,541.17	
Minnesota	326,578.02	326,578.02	
Iowa	415,520.62	415,520.62	
Missouri	365,827.21	365,827.21	
South Dakota	223,488.53	223,488.53	
Nebraska	309,011.46	309,011.46	
Total	3,012,278.59	3,012,278.59	
Western Region:			
North Dakota	121,689.32	121,689.32	
Kansas	127,566.52	127,566.52	
Montana	69,412.43	69,412.43	
Idaho	34,536.98	34,536.98	
Wyoming	21,570.13	21,570.13	
Colorado	70,158.03	70,158.03	
New Mexico	46,677.42	46,677.42	
Arizona	28,428.87	28,428.87	
Utah	18,104.63	18,104.63	
Nevada	8,120.22	8,120.22	
Washington	36,581.81	36,581.81	
Oregon	53,256.45	53,256.45	
California	125,464.74	125,464.74	
Total	761,567.55	761,567.55	
Grand total	5,947,322.95	5,945,333.48	$1,989.47

Exhibit 15.—RENTAL AND BENEFIT PAYMENTS JAN. 1, 1937, THROUGH JUNE 30, 1938, BY STATES AND COMMODITIES

	Total	Cotton	Wheat	Tobacco
Alabama	$30,891.11	$15,468.04		$53.42
Arizona	10,250.92	2,745.37	$7,666.85	
Arkansas	38,423.30	31,199.41	4,316.52	31.50
California	764,893.74	3,809.52	538,218.50	
Colorado	370,012.03		281,050.03	
Connecticut	3,038.76			2,971.86
Delaware	68,547.86		67,314.77	
Florida	6,590.18	262.50		127.47
Georgia	23,301.61	10,328.97	845.56	2,643.01
Idaho	604,646.79		592,991.45	
Illinois	321,645.55	11.64	272,774.11	
Indiana	162,610.35		124,869.34	1,487.70
Iowa	185,398.25		139,208.74	
Kansas	1,175,336.47	9.27	1,143,648.74	577.35
Kentucky	80,637.66	491.05	14,851.03	35,910.87
Louisiana	281,741.99	6,948.14		
Maryland	136,516.00		101,150.93	33,972.22
Massachusetts	1,688.48			1,152.82
Michigan	71,673.53		36,406.52	
Minnesota	279,863.99		187,238.33	1,307.12
Mississippi	20,464.98	7,669.53		
Missouri	215,751.53	9,326.28	153,116.26	5,314.66
Montana	729,086.60		702,085.58	
Nebraska	2,606,854.14		2,505,092.01	
Nevada	2,062.55		1,080.92	
New Hampshire	150.00			
New Jersey	1,133.63		1,047.11	
New Mexico	61,640.23	990.23	59,621.23	
New York	26,200.62		22,570.69	115.04
North Carolina	31,595.98	9,100.37	4,196.45	14,108.34
North Dakota	1,042,455.98		898,133.53	

Exhibit 15.—RENTAL AND BENEFIT PAYMENTS JAN. 1, 1937, THROUGH JUNE 30,1938, BY STATES AND COMMODITIES—Continued

	Total	Cotton	Wheat	Tobacco
Ohio	$84,890.07		$53,299.10	$11,317.84
Oklahoma	298,891.08	$30,856.03	257,755.58	
Oregon	320,956.60		319,560.18	
Pennsylvania	64,185.13		59,522.41	2,091.37
Philippine Islands	17,215.55			
Puerto Rico	1,578,586.76			17,044.80
South Carolina	9,504.59	5,835.93		2,449.66
South Dakota	534,310.95		494,615.61	
Tennessee	71,407.96	9,175.29	16,448.96	36,530.80
Texas	488,285.29	96,801.61	380,714.19	
Utah	78,144.54		69,675.14	
Vermont	996.10			
Virginia	47,500.19	369.24	36,027.44	5,832.37
Washington	438,313.03		425,705.55	
West Virginia	29,974.90		27,494.25	799.31
Wisconsin	21,795.18		3,509.64	1,347.34
Wyoming	73,847.17		39,981.54	
Total	13,513,909.90	241,398.42	10,043,804.79	177,186.87
Undistributed	*—50,226.76*			
Total disbursed	13,463,683.14			

	Corn-hogs	Sugar	Rice	Peanuts	Rye
Alabama	$1,860.17	$13,140.15		$369.33	
Arizona	*—161.30*				
Arkansas	1,828.70	.65	$1,046.52		
California	4,113.90	218,751.82			
Colorado	26,188.86	62,609.34			$163.80
Connecticut	66.90				
Delaware	1,233.09				
Florida	1,572.29	4,490.75		137.17	
Georgia	202.94	8,882.40		398.73	
Idaho	*—1,511.27*	13,166.61			
Illinois	46,570.28	806.89			1,482.63
Indiana	34,670.37	1,127.36			455.58
Iowa	45,469.66	719.85			
Kansas	24,993.52	6,069.79			37.80
Kentucky	29,384.71				
Louisiana	329.51	273,874.65	589.69		
Maryland	1,357.16				35.69
Massachusetts	535.66				
Michigan	2,803.99	32,411.81			51.21
Minnesota	34,934.24	3,242.45			53,141.85
Mississippi	575.81	12,219.64			
Missouri	47,498.28				496.05
Montana	2,047.51	23,595.19			1,358.32
Nebraska	82,704.38	13,315.25			5,742.50
Nevada	981.63				
New Hampshire	150.00				
New Jersey	86.52				
New Mexico	756.94	271.83			
New York	3,514.89				
North Carolina	3,120.55			1,070.27	
North Dakota	9,453.93	949.16			133,919.36
Ohio	14,205.83	6,024.38			42.92
Oklahoma	10,136.52			102.00	40.95
Oregon	1,268.40	128.02			
Pennsylvania	2,504.29				67.06
Philippine Islands		17,215.55			
Puerto Rico		1,561,541.96			
South Carolina	1,219.00				
South Dakota	27,706.45	4,453.27			7,535.62
Tennessee	9,218.35			34.56	
Texas	8,451.70	461.16	1,704.23	152.40	
Utah	565.53	7,903.87			
Vermont	996.10				
Virginia	5,065.98			205.16	
Washington	1,103.58	11,503.90			
West Virginia	1,681.34				
Wisconsin	4,344.84	12,593.36			
Wyoming	1,021.35	32,844.28			
Total	496,823.08	2,344,315.34	3,340.44	2,469.62	204,571.34

Exhibit 16.—ADMINISTRATION OF 1937 PROGRAM UNDER THE SUGAR ACT OF 1937, JAN. 1, 1937, THROUGH JUNE 30, 1938

	Performance payments
North Central Region:	
Ohio	$128, 392. 18
Illinois	3, 668. 51
Wisconsin	80, 849. 36
Minnesota	364, 354. 90
South Dakota	83, 194. 17
Nebraska	777, 586. 67
Total	1, 438, 045. 79
Western Region:	
North Dakota	230, 889. 37
Kansas	259. 61
Montana	$834, 667. 80
Idaho	55, 333. 06
Wyoming	786, 481. 61
Colorado	441, 727. 13
Utah	50, 513. 07
Washington	97, 637. 39
Oregon	99, 017. 76
California	1, 690, 833. 65
Total	4, 287, 360. 45
Grand total	5, 725, 406. 24

Exhibit 17.—PAYMENTS FOR PURCHASE AND DIVERSION OF AGRICULTURAL COMMODITIES, JAN. 1, 1937, THROUGH JUNE 30, 1938

Commodities:	*Amount*
Apples	$118, 494. 74
Beans	6, 630. 27
Cabbage	78, 217. 10
Cauliflower	22, 103. 86
Carrots	801. 18
Cattle	4, 194. 89
Citrus fruits	3, 309, 988. 67
Coffee	234, 767. 76
Cotton	166, 782. 41
Dairy products	4, 157, 245. 35
Dates	69, 944. 53
Eggs	2, 182, 510. 29
Figs	120, 818. 86
Filberts	44, 426. 45
Flax for fiber	58, 282. 56
Flour	188, 271. 92
Hogs	28, 056. 63
Hops	569, 905. 00
Onions	495, 675. 77
Peaches	$14, 716. 41
Peanuts	2, 138, 306. 49
Pears	146, 896. 05
Peas	140, 065. 88
Pecans	205, 617. 04
Potatoes	1, 893, 372. 16
Prunes	1, 558, 879. 69
Raisins	81, 727. 28
Seeds	103, 544. 81
Sheep and goats	75. 00
Sweetpotatoes	7, 950. 92
Sirup	36, 743. 33
Tobacco	3, 086, 542. 84
Walnuts	1, 215, 442. 05
Wheat	3, 326, 421. 26
Transportation	538, 700. 55
Total	26, 352, 120. 00

Exhibit 18.—TOTAL EXPENDITURES JAN. 1, 1937, THROUGH JUNE 30, 1938, BY STATES

State:	Amount	State—Continued.	Amount
Washington, D.C.	$12, 705, 436. 99	Nevada	$350, 999. 95
Alabama	15, 239, 908. 78	New Hampshire	276, 629. 48
Alaska	4, 450. 36	New Jersey	1, 111, 462. 08
Arizona	2, 290, 256. 78	New Mexico	5, 330, 835. 49
Arkansas	20, 253, 763. 40	New York	5, 575, 006. 90
California	12, 477, 664. 76	North Carolina	20, 939, 369. 77
Colorado	9, 121, 381. 78	North Dakota	33, 184. 207. 74
Connecticut	665, 196. 36	Ohio	14, 335, 884. 52
Delaware	720, 976. 64	Oklahoma	26, 818, 201. 86
Florida	2, 806, 799. 93	Oregon	4, 882, 146. 68
Georgia	15, 683, 621. 79	Pennsylvania	5, 037, 531. 83
Hawaii	1, 219, 312. 91	Philippine Islands	40. 502 67
Idaho	5, 170, 855. 33	Puerto Rico	2, 915, 059. 23
Illinois	23, 500, 501. 55	Rhode Island	41, 089. 25
Indiana	15, 447, 815. 06	South Carolina	13, 118, 054. 46
Iowa	41, 173, 961. 24	South Dakota	28, 182, 788. 23
Kansas	32, 600, 514. 60	Tennessee	14, 986, 073. 34
Kentucky	21, 040, 400. 21	Texas	70, 652, 887. 75
Louisiana	12, 591, 440. 17	Utah	1, 866, 157. 62
Maine	1, 039, 622. 19	Vermont	624, 997. 90
Maryland	2, 774, 700. 83	Virginia	6, 035, 305. 62
Massachusetts	499, 814. 83	Washington	4, 857, 145. 26
Michigan	12, 555, 000. 53	West Virginia	1, 755, 874. 31
Minnesota	30, 170, 048. 36	Wisconsin	18, 417, 813. 95
Mississippi	20, 077, 054. 25	Wyoming	3, 603, 562. 44
Missouri	20, 919, 681. 34	Undistributed	26, 246, 315. 36
Montana	15, 510, 938. 49		
Nebraska	28, 796, 597. 02	Total	688, 243, 617. 17

Exhibit 19.—GENERAL ADMINISTRATIVE EXPENSES, JAN. 1, 1937, THROUGH JUNE 30, 1938

BY OBJECTIVE CLASSIFICATION

	Total	Washington, D. C.	Field
Salaries	$22, 981, 031. 61	$9, 343, 093. 15	$13, 637, 938. 46
Other expenses:			
Supplies	999, 439. 30	460, 691. 78	538, 747. 52
Communications	243, 537. 39	146, 606. 49	96, 930. 90
Travel	2, 123, 672. 36	757, 431. 56	1, 366, 240. 80
Transportation of things	407, 822. 47	273, 137. 62	134, 684. 85
Printing and binding [1]	2, 353, 185. 66	533, 951. 19	1, 819, 234. 47
Rents	422, 453. 59	110, 978. 50	311, 475. 09
Equipment	1, 020, 849. 70	191, 859. 14	828, 990. 56
Miscellaneous	1, 633, 312. 06	887, 687. 56	745, 624. 50
Total other expenses	9, 204, 272. 53	3, 362, 343. 84	5, 841, 928. 69
Total	32, 185, 304. 14	12, 705, 436. 99	19, 479, 867. 15

[1] Including aerial photography.

Exhibit 19.—GENERAL ADMINISTRATIVE EXPENSES, JAN. 1, 1937, THROUGH JUNE 30, 1938—Continued

BY AGRICULTURAL ADJUSTMENT ADMINISTRATION AND COOPERATING AGENCIES

Agricultural Adjustment Administration	$27,783,569.93	$10,819,963.67	$16,963,606.26
Bureau of Agricultural Economics	330,621.97	111,275.37	219,346.60
Bureau of Animal Industry	32,216.26	30,600.71	1,615.55
Bureau of Census	25,924.00	25,924.00	
Extension Service	2,191,756.36	52,130.56	2,139,625.80
Farm Credit Administration	3,600.00	3,600.00	
Forest Service	169,020.46	13,347.52	155,672.94
Bureau of Home Economics	10,648.69	10,648.69	
Bureau of Internal Revenue	−670.92	−670.92	
Department of Justice	5,100.00	5,100.00	
Library	6,210.00	6,210.00	
Office of Information	20,657.27	20,657.27	
Office of Land Use Planning	4,347.63	4,347.63	
Office of Solicitor	544,593.67	544,593.67	
Bureau of Plant Industry	30,526.74	30,526.74	
Secretary's Office	399,406.96	399,406.96	
Soil Conservation Service	5,673.85	5,673.85	
General Accounting Office	198,014.02	198,014.02	
Treasury Department, Division of Disbursements	424,087.25	424,087.25	
Total	32,185,304.14	12,705,436.99	19,479,867.15

Exhibit 20.—MISCELLANEOUS EXPENDITURES, JAN. 1, 1937, THROUGH JUNE 30, 1938, BY STATES

State:	*Amount*	State—Continued.	*Amount*
Alabama	$52,750.83	New Mexico	$10,109.73
Arizona	34,300.50	North Carolina	209,887.32
Arkansas	251,614.01	Ohio	5.70
California	57,982.61	Oklahoma	86,857.39
Florida	3,964.81	South Carolina	24,953.10
Georgia	42,571.28	Tennessee	44,270.63
Illinois	213.50	Texas	849,587.06
Kansas	2.03	Virginia	7,349.01
Kentucky	1,827.47	Undistributed	−17,599.22
Louisiana	141,741.54		
Mississippi	347,567.37	Total	2,157,945.94
Missouri	7,989.27		

Appendix F.—DATA ON PARTICIPATION AND ESTIMATED PAYMENTS EARNED, 1937 AGRICULTURAL CONSERVATION PROGRAM (PRELIMINARY)

Exhibit 21.—ESTIMATED PAYMENTS EARNED, BY CLASSES OF PAYMENT AND BY CROP CLASSIFICATIONS, 1937 AGRICULTURAL CONSERVATION PROGRAM, BY STATES AND REGIONS (PRELIMINARY)

[Figures in thousands of dollars, i. e., 000 omitted]

State and region	Class I payments							Class II	Total crop payments	Range	Naval stores	Grand total
	General	Cotton	Tobacco	Peanuts	Rice	Sugar cane and beets	Total					
NORTHEAST REGION												
Maine	367						367	493	860			860
New Hampshire			(1)				(1)	191	191			191
Vermont			(1)				(1)	456	456			456
Massachusetts			54				54	312	366			366
Rhode Island								27	27			27
Connecticut			102				102	238	340			340
New York			7				7	3,925	3,932			3,932
New Jersey								931	931			931
Pennsylvania	426		92				518	2,799	3,317			3,317
Total	793		255				1,048	9,372	10,420			10,420
NORTH CENTRAL REGION												
Ohio	3,494		206			46	3,746	2,100	5,846			5,846
Indiana	4,284		70			8	4,362	1,767	6,129			6,129
Illinois	6,430	5				2	6,437	1,980	8,417			8,417
Michigan	3,394					162	3,556	2,512	6,068			6,068
Wisconsin	4,623		207			19	4,849	3,226	8,075			8,075
Missouri	6,437	432	49		1		6,919	2,393	9,312			9,312
South Dakota	8,771					25	8,796	3,701	12,497	788		13,285
Minnesota	10,249		3			65	10,317	2,375	12,692			12,692
Iowa	14,212					8	14,220	3,040	17,260			17,260
Nebraska	7,855					285	8,140	2,393	10,533	350		10,883
Total	69,749	437	535		1	620	71,342	25,487	96,829	1,138		97,967
EAST CENTRAL REGION												
Delaware	265						265	200	465			465
Maryland	619		125				744	685	1,429			1,429
Virginia	1,098	181	649	89			2,017	1,494	3,511			3,511
West Virginia	420		28				448	675	1,123			1,123
North Carolina	402	4,058	3,973	175			8,608	1,402	10,010			10,010
Kentucky	2,852	71	3,742				6,665	4,252	10,917			10,917
Tennessee	1,727	2,756	915	7			5,405	2,283	7,688			7,688
Total	7,383	7,066	9,432	271			24,152	10,991	35,143			35,143
SOUTHERN REGION												
South Carolina	244	4,603	542	27			5,416	602	6,018		9	6,027
Georgia	16	5,986	424	238			6,664	1,417	8,081		181	8,262
Florida	137	120	48	32		81	418	1,035	1,453		143	1,596
Alabama	97	6,916	1	138			7,152	1,302	8,454		22	8,476
Mississippi	3	7,645					7,648	1,855	9,503		2	9,505
Louisiana	28	3,884			1,104	619	5,635	922	6,557		1	6,558
Arkansas	645	6,175			578		7,398	1,685	9,083			9,083
Oklahoma	5,184	5,075		25			10,284	1,959	12,243	290		12,533
Texas	9,754	19,372			643	121	29,890	3,844	33,734	4,701	1	38,436
Total	16,108	59,776	1,015	460	2,325	821	80,505	14,621	95,126	4,991	359	100,476

[1] Less than $500.

Exhibit 21.—ESTIMATED PAYMENTS EARNED, BY CLASSES OF PAYMENT AND BY CROP CLASSIFICATIONS, ETC.—Continued

[Figures in thousands of dollars, i. e., 000 omitted]

State and region	Class I payments							Class II	Total crop payments	Range	Naval stores	Grand total
	General	Cotton	Tobacco	Peanuts	Rice	Sugar cane and beets	Total					
WESTERN REGION												
Arizona	131	585	------	------	------	------	716	163	879	268	------	1,147
California	1,645	518	------	------	445	567	3,175	2,567	5,742	283	------	6,025
Colorado	2,579	------	------	------	------	663	3,242	1,505	4,747	197	------	4,944
Idaho	1,049	------	------	------	------	207	1,256	610	1,866	45	------	1,911
Kansas	9,778	1	1	------	------	19	9,799	5,341	15,140	141	------	15,281
Nevada	46	------	------	------	------	------	46	80	126	34	------	160
New Mexico	757	289	------	------	------	(1)	1,046	772	1,818	881	------	2,699
North Dakota	11,338	------	------	------	------	35	11,373	2,551	13,924	67	------	13,991
Oregon	1,191	------	------	------	------	12	1,203	1,090	2,293	174	------	2,467
Washington	1,063	------	------	------	------	23	1,086	712	1,798	53	------	1,851
Montana	4,251	------	------	------	------	347	4,598	2,410	7,008	412	------	7,420
Utah	350	------	------	------	------	189	539	365	904	25	------	929
Wyoming	555	------	------	------	------	231	786	404	1,190	460	------	1,650
Total	34,733	1,393	1	------	445	2,293	38,865	18,570	57,435	3,040	------	60,475
United States total	128,766	68,672	11,238	731	2,771	3,734	215,912	79,041	294,953	9,169	359	304,481

[1] Less than $500.

Exhibit 22.—DATA ON PARTICIPATION AND ESTIMATED TOTAL PAYMENTS, 1937 AGRICULTURAL CONSERVATION PROGRAM, BY STATES, TERRITORIES, AND REGIONS (PRELIMINARY)

State and region	Number of application farms [1]	Cropland on application	Total cropland acreage in State [2]	Percent cropland covered	Base acreage on applications for payment	
					General	Cotton
Northeast Region:		*Acres*	*Acres*		*Acres*	*Acres*
Maine	10,661	732,888	1,476,422	49.6	225,115	------
New Hampshire	5,378	224,184	469,076	47.8	94	------
Vermont	6,437	477,656	1,162,726	41.1	41	------
Massachusetts	7,310	253,120	635,548	39.8	7,750	------
Rhode Island	514	22,836	81,554	28.0	------	------
Connecticut	4,935	225,705	563,359	40.1	9,506	------
New York	48,935	3,879,818	8,846,756	43.9	4,698	------
New Jersey	11,555	769,286	1,105,579	69.6	------	------
Pennsylvania	56,031	3,872,810	8,298,581	46.8	591,233	------
Total	151,756	10,458,303	22,639,601	46.3	838,437	------
North Central Region:						
Ohio	131,000	7,351,000	12,875,572	57.1	4,721,500	------
Indiana	91,788	6,736,552	13,523,837	49.8	4,753,282	------
Illinois	95,000	9,200,000	23,078,768	39.9	6,950,000	1,250
Michigan	127,200	8,045,066	10,731,946	75.0	4,485,014	------
Wisconsin	148,000	9,985,699	11,578,447	86.2	6,145,247	------
Missouri	160,615	11,497,040	16,054,617	71.6	7,816,460	195,489
South Dakota	81,801	14,130,336	16,842,968	83.9	12,507,664	------
Minnesota	125,739	13,620,190	19,469,395	70.0	10,656,029	------
Iowa	143,203	14,617,785	24,228,896	60.3	11,905,684	------
Nebraska	88,250	12,615,038	20,446,092	61.7	11,055,168	------
Total	1,192,596	107,798,706	168,830,538	63.9	80,996,048	196,739

[1] For the North Central Region, data are numbers of applications which exceed number of application farms.

[2] Includes rotation pasture. Computation was made as follows: For the Northeast Region, estimates of rotation pasture acreage in 1934, as made by the Economic and Research Section of the East Central Division, were added to 1934 Census cropland acreage; for the Southern Region, rotation pasture, as reported in the 1929 Census, was added to 1934 Census cropland acreage; for the North Central, East Central, and Western Regions, total cropland was obtained from worksheets, the county committees in those regions having been instructed to obtain a worksheet for every farm.

Exhibit 22.—DATA ON PARTICIPATION AND ESTIMATED TOTAL PAYMENTS, ETC.—Continued

State and region	Number of application farms	Cropland on application	Total cropland acreage in State	Percent cropland covered	Base acreage on applications for payment	
					General	Cotton
East Central Region:		*Acres*	*Acres*		*Acres*	*Acres*
Delaware	4,426	397,277	591,925	67.1	239,779	
Maryland	14,700	1,635,767	2,506,848	65.3	725,434	
Virginia	51,500	3,186,064	5,882,601	54.2	1,473,796	50,063
West Virginia	27,350	1,050,100	2,009,668	52.3	475,810	
North Carolina	108,000	5,275,947	8,131,128	64.9	1,898,300	1,066,655
Kentucky	120,000	9,171,417	11,135,952	82.4	3,064,350	19,831
Tennessee	87,000	6,093,746	9,876,361	61.7	2,239,378	833,954
Total	412,976	26,810,318	40,134,483	66.8	10,116,847	1,970,503
Southern Region:						
North Carolina	60,700	3,531,000	5,309,887	66.5	1,212,000	1,538,000
Georgia	91,100	6,561,000	10,890,102	60.2	2,293,000	2,447,000
Florida	24,700	1,356,000	2,181,676	62.2	578,000	78,000
Alabama	124,800	6,419,000	8,448,182	76.0	2,224,000	2,761,000
Mississippi	78,700	5,898,000	7,743,426	76.2	1,799,000	3,202,000
Louisiana	64,100	4,085,000	4,924,636	83.0	994,000	1,494,000
Arkansas	95,200	6,426,000	8,115,013	79.2	2,093,000	2,663,000
Oklahoma	97,700	9,658,000	17,172,008	56.2	5,641,000	2,288,000
Texas	191,200	22,974,000	35,924,410	64.0	11,603,000	9,691,000
Total	828,200	66,908,000	100,709,340	66.4	28,437,000	26,162,000
Western Region:						
Arizona	3,047	352,000	625,874	56.2	114,092	136,233
California	45,835	5,314,913	10,068,240	52.8	2,196,375	78,629
Colorado	38,959	6,288,781	9,024,820	69.7	4,927,744	
Idaho	18,696	1,944,331	3,404,000	57.1	1,327,836	
Kansas	101,168	16,900,000	29,172,975	57.9	14,941,343	575
Nevada	1,395	195,830	462,312	42.4	39,211	
New Mexico	15,904	1,526,866	2,455,731	62.2	1,233,922	87,730
North Dakota	100,765	21,095,534	24,886,664	84.8	16,868,646	
Oregon	22,164	2,682,638	3,678,363	72.9	2,007,804	
Washington	20,294	2,786,268	5,675,411	49.1	2,406,495	
Montana	40,912	9,110,907	10,690,657	85.2	7,362,262	
Utah	15,756	991,000	1,362,919	72.7	509,648	
Wyoming	9,614	1,464,946	2,083,825	70.3	833,292	
Total	434,509	70,654,014	103,591,791	68.2	54,768,670	303,167
Total, United States	3,020,037	282,629,341	435,905,753	64.8	175,157,002	28,632,409

State and region	Base acreage on applications for payment—Continued			Number of payees	Estimated total payments	Average payment per payee
	Tobacco	Peanuts	Total [3]			
Northeast Region:	*Acres*	*Acres*	*Acres*		*Dollars*	*Dollars*
Maine			225,115	10,740	860,000	80.08
New Hampshire	27		121	5,397	191,000	35.45
Vermont	14		55	6,522	456,000	69.93
Massachusetts	6,024		13,774	7,336	366,000	49.95
Rhode Island				514	27,000	53.35
Connecticut	10,915		20,421	4,962	340,000	68.43
New York	606		5,304	50,357	3,932,000	78.07
New Jersey				12,290	931,000	75.72
Pennsylvania	14,459		605,692	58,525	3,317,000	56.67
Total	32,045		870,482	156,643	10,420,000	66.52

[3] Excludes rice, sugar beets, and sugarcane.

Exhibit 22.—DATA ON PARTICIPATION AND ESTIMATED TOTAL PAYMENTS, ETC.—Continued

State and region	Base acreage on applications for payment—Continued			Number of payees	Estimated total payments	Average payment per payee
	Tobacco	Peanuts	Total			
North Central Region:	*Acres*	*Acres*	*Acres*		*Dollars*	*Dollars*
Ohio	21,750		4,743,250	86,444	5,846,000	67.62
Indiana	8,576		4,761,858	69,544	6,129,000	88.14
Illinois			6,951,250	71,489	8,417,000	117.74
Michigan			4,485,014	101,783	6,068,000	59.61
Wisconsin	21,865		6,167,112	132,325	8,075,000	61.02
Missouri	4,221		8,016,170	111,017	9,312,000	83.88
South Dakota			12,507,664	84,084	13,285,000	158.00
Minnesota	352		10,656,381	115,564	12,692,000	109.83
Iowa			11,905,684	121,218	17,260,000	142.39
Nebraska			11,055,168	78,679	10,883,000	138.32
Total	56,764		81,249,551	972,147	97,967,000	100.77
East Central Region:						
Delaware			239,779	5,931	465,000	78.36
Maryland	18,532		743,966	17,346	1,429,000	82.37
Virginia	93,721	74,884	1,692,464	70,040	3,511,000	50.13
West Virginia	3,254		479,064	28,718	1,123,000	39.11
North Carolina	493,161	130,755	3,588,871	192,240	10,010,000	52.07
Kentucky	437,105		3,521,286	190,800	10,917,000	57.21
Tennessee	111,463	5,045	3,189,840	158,340	7,688,000	48.55
Total	1,157,236	210,684	13,455,270	663,415	35,143,000	52.50
Southern Region:						
South Carolina	52,000	4,000	2,806,000	93,000	6,027,000	64.80
Georgia	56,000	298,000	5,094,000	152,000	8,262,000	54.35
Florida	7,000	28,000	691,000	25,800	1,596,000	61.87
Alabama	200	192,000	5,177,200	192,500	8,476,000	44.03
Mississippi			5,001,000	203,300	9,505,000	46.75
Louisiana			2,488,000	127,000	6,558,000	51.64
Arkansas			4,755,000	174,200	9,083,000	52.14
Oklahoma		19,000	7,948,000	141,800	12,533,000	88.39
Texas		134,000	21,428,000	327,200	38,436,000	117.47
Total	115,200	675,000	55,389,200	1,436,800	100,476,000	69.68
Western Region:						
Arizona			250,325	3,293	1,147,000	348.40
California			2,275,004	49,708	6,025,000	121.21
Colorado			4,927,744	39,309	4,944,000	125.77
Idaho			1,327,836	19,357	1,911,000	98.72
Kansas	89		14,942,007	103,858	15,281,000	147.13
Nevada			39,211	1,414	160,000	113.00
New Mexico			1,321,652	19,127	2,699,000	141.13
North Dakota			16,868,646	103,776	13,991,000	134.82
Oregon			2,007,804	23,627	2,467,000	104.41
Washington			2,406,495	21,003	1,851,000	88.11
Montana			7,362,262	44,413	7,420,000	167.08
Utah			509,648	15,806	929,000	58.76
Wyoming			833,292	11,777	1,650,000	140.06
Total	89		55,071,926	456,468	60,475,000	132.48
Insular Region:						
Alaska				126	3,000	20.12
Hawaii				5,305	760,000	143.26
Puerto Rico				53,000	1,500,000	28.30
Total				58,431	2,263,000	38.72
Total, United States and Insular	1,361,334	885,684	206,036,429	3,743,904	306,744,000	81.93

Exhibit 23.—ESTIMATED NUMBER OF PAYEES RECEIVING NET PAYMENTS FALLING WITHIN SPECIFIED SIZE-OF-PAYMENT GROUPS, 1937 AGRICULTURAL CONSERVATION PROGRAM, BY REGIONS (PRELIMINARY)

Size of payment	Northeast	East Central	Southern	North Central	Western	Total United States
Under $20.00	34,867	224,519	529,300	205,109	97,746	1,091,541
$20.01-$40.00	39,706	159,876	330,800	162,811	80,129	773,322
$40.01-$60.00	31,133	86,496	185,300	140,339	55,288	498,556
$60.01-$100.00	30,271	99,166	173,100	182,215	71,038	555,790
$100.01-$150.00	11,144	45,812	85,600	121,201	50,573	314,330
$150.01-$200.00	4,661	20,051	37,380	61,497	30,194	153,783
$200.01-$300.00	2,851	15,210	31,750	53,650	31,876	135,337
$300.01-$400.00	1,218	5,508	12,780	21,276	15,786	56,568
$400.01-$500.00	365	2,495	6,820	10,347	8,736	28,763
$500.01-$1,000.00	372	3,328	10,329	11,239	11,578	36,846
$1,000.01-$2,000.00	43	726	3,986	1,948	2,689	9,392
$2,000.01-$3,000.00	6	82	919	410	514	1,931
$3,000.01-$4,000.00	2	55	336	42	148	583
$4,000.01-$5,000.00		50	166	30	63	309
$5,000.01-$10,000.00	4	41	190	33	83	351
Above $10,000.00			67		27	94
Total	156,643	663,415	1,408,823	972,147	456,468	3,657,496

Exhibit 24.—DATA IN PARTICIPATION AND ESTIMATED PAYMENTS TO BE EARNED ON 1937–38 SUGAR-BEET AND SUGARCANE CROP, 1937 SUGAR PROGRAM, BY STATES AND TERRITORIES (PRELIMINARY)

	Number of applicants	Total amounts due growers	Amounts to be deducted from growers' payments for settlement of labor claims
Sugar-beet States:			
California	1,363	$3,750,000	$67,000
Colorado	7,841	3,600,000	120,000
Idaho	4,761	1,090,000	30,000
Illinois	324	41,000	1,500
Indiana	690	90,000	
Iowa	146	50,000	1,000
Kansas	217	98,000	
Michigan	10,429	1,075,000	18,000
Minnesota	988	489,000	7,000
Montana	2,955	1,800,000	32,000
Nebraska	2,377	1,710,000	31,000
New Mexico	31	1,000	
North Dakota	368	270,000	5,000
Ohio	3,164	328,000	
Oregon	307	124,000	4,000
South Dakota	272	103,000	4,000
Utah	7,137	1,090,000	10,000
Washington	818	210,000	
Wisconsin	1,965	148,000	1,500
Wyoming	1,577	1,193,000	43,000
Total	47,724	17,260,000	375,000
Sugarcane States:			
Florida	19	487,000	
Louisiana	10,800	5,600,000	
Total	10,819	6,087,000	
Insular areas:			
Hawaii	75	4,200,000	
Puerto Rico	11,000	9,300,000	(1)
Total	11,075	13,500,000	
Grand total	69,618	36,847,000	

[1] No estimate.

Appendix G.—MARKETING PROGRAMS

Exhibit 25.—MARKETING AGREEMENTS, LICENSES, AND ORDERS IN EFFECT AS OF JUNE 30, 1938

Marketing agreements:
- Milk—
  - Dry skim.
  - Fort Wayne, Ind.
  - Topeka, Kans.
- Peaches, fresh, grown in Colorado.

Marketing agreements and orders:
- Anti-hog-cholera serum.
- Cauliflower, Oregon.
- Celery, Florida.
- Citrus, California and Arizona.
- Citrus, Texas.
- Onions, Utah.
- Vegetables, Colorado peas and cauliflower.
- Vegetables, western Washington.
- Walnuts, California, Oregon, and Washington.
- Watermelons, southeastern.
- Milk, Cincinnati.
- Cantaloups, California and Arizona.

Marketing agreements and licenses:
- Alcoholic beverages importing industry.[1]
- Bees and queens, shippers.[1]
- Deciduous tree fruits, California.
- Evaporated milk.
- Prunes, California dried.
- Tobacco, Connecticut Valley shade grown.
- Vegetables, western Washington.
- Watermelons, southeastern.

Orders:
- Milk—Boston, Mass.; Fall River, Mass.; La Porte, Ind.; Dubuque, Iowa; Kansas City, Mo.; St. Louis, Mo.
- Potatoes, Nebraska, Wyoming, and Colorado.
- Potatoes, Idaho.
- Potatoes, Wisconsin, Minnesota, North Dakota, and Michigan.
- Potatoes, Louisiana, Texas, Alabama, Mississippi, and Florida.

Licenses:
- Milk—Battle Creek, Denver, Kalamazoo, Leavenworth, Des Moines, Lincoln, Louisville, New Bedford, Omaha-Council Bluffs, Quad Cities, San Diego, Sioux City, Twin Cities, Wichita.

Appendix H—MISCELLANEOUS

Exhibit 26—ANNOTATED COMPILATION OF THE SOIL CONSERVATION AND DOMESTIC ALLOTMENT ACT, AS AMENDED, THE AGRICULTURAL ADJUSTMENT ACT OF 1938, AS AMENDED, AND ACTS RELATING THERETO

PREFATORY NOTE

Throughout this compilation, light-faced type is used to indicate the law as originally enacted, italics are used to indicate amendments to the original text, and bold-faced type is used to indicate amendments to amendments to the original text.

In the case of the Soil Conservation and Domestic Allotment Act, the law as originally enacted is considered, for the purposes of this compilation, to be the act entitled "An act to provide for the protection of land resources against soil erosion, and for other purposes," Public, No. 46, Seventy-fourth Congress, approved April 27, 1935, as amended by section 1 of the act entitled "An act to promote the conservation and profitable use of agricultural land resources by

[1] Inoperative—but not terminated.

temporary Federal aid to farmers and by providing for a permanent Federal aid to States for such purposes," Public, No. 461, Seventy-fourth Congress, approved February 29, 1936.

Footnotes are used to indicate the sources of the text.

In the annotated compilation of the Agricultural Adjustment Act of 1938, contained in part II of this compilation, title I of that act is omitted. As explained in the footnote to the text, an annotated compilation of that title is omitted because that title contains only amendments to the Soil Conservation and Domestic Allotment Act, and these amendments are shown in the annotated compilation of the Soil Conservation and Domestic Allotment Act, as amended, contained in part I of this compilation.

PART I.—ANNOTATED COMPILATION OF SOIL CONSERVATION AND DOMESTIC ALLOTMENT ACT, AS AMENDED [1]

An act to provide for the protection of land resources against soil erosion and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it is hereby recognized that the wastage of soil and moisture resources on farm, grazing, and forest lands of the Nation, resulting from soil erosion, is a menace to the national welfare and that it is hereby declared to be the policy of Congress to provide permanently for the control and prevention of soil erosion and thereby to preserve natural resources, control floods, prevent impairment of reservoirs, and maintain the navigability of rivers and harbors, protect public health, public lands, and relieve unemployment, and the Secretary of Agriculture, from now on, shall coordinate and direct all activities with relation to soil erosion and in order to effectuate this policy is hereby authorized from time to time—

(1) To conduct surveys, investigations, and research relating to the character of soil erosion and the preventive measures needed, to publish the results of any such surveys, investigations, or research, to disseminate information concerning such methods, and to conduct demonstrational projects in areas subject to erosion by wind or water;

(2) To carry out preventive measures, including, but not limited to, engineering operations, methods of cultivation, the growing of vegetation, and changes in use of land;

(3) To cooperate or enter into agreements with, or to furnish financial or other aid to, any agency, governmental or otherwise, or any person, subject to such conditions as he may deem necessary, for the purposes of this Act; and

(4) To acquire lands, or rights or interests therein, by purchase, gift, condemnation, or otherwise, whenever necessary for the purposes of this Act.

SEC. 2. The acts authorized in section 1 (1) and (2) may be performed—

(a) On lands owned or controlled by the United States or any of its agencies, with the cooperation of the agency having jurisdiction thereof; and

(b) On any other lands, upon obtaining proper consent or the necessary rights or interests in such lands.

SEC. 3. As a condition to the extending of any benefits under this Act to any lands not owned or controlled by the United States or any of its agencies, the Secretary of Agriculture may, insofar as he may deem necessary for the purposes of this Act, require—

(1) The enactment and reasonable safeguards for the enforcement of State and local laws imposing suitable permanent restrictions on the use of such lands and otherwise providing for the prevention of soil erosion;

(2) Agreements or covenants as to the permanent use of such lands; and

(3) Contributions in money, services, materials, or otherwise, to any operations conferring such benefits.

SEC. 4. For the purposes of this Act, the Secretary of Agriculture may—

(1) Secure the cooperation of any governmental agency;

(2) Subject to the provisions of the civil-service laws and the Classification Act of 1923, as amended, appoint and fix the compensation of such officers and

[1] Sec. 1 through 6 constituted the act of April 27, 1935, Public, No. 46, 74th Cong., 49 Stat. 163, Title 16, U. S. C., sec. 590–a to 590–f; sec. 7 through 17 were added by sec. 1 of the act entitled "An act to promote the conservation and profitable use of agricultural land resources by temporary Federal aid to farmers and by providing for a permanent policy of Federal aid to States for such purposes," approved February 29, 1936, Public, No. 461, 74th Cong., 49 Stat. 1148, Title 16, U. S. C., secs. 590–g to 590–q.

employees as he may deem necessary, except for a period not to exceed eight months from the date of this enactment, the Secretary of Agriculture may make appointments and may continue employees of the organization heretofore established for the purpose of administering those provisions of the National Industrial Recovery Act which relate to the prevention of soil erosion, without regard to the civil-service laws or regulations and the Classification Act, as amended; and any persons with technical or practical knowledge may be employed and compensated under this Act on a basis to be determined by the Civil Service Commision; and

(3) Make expenditures for personal services and rent in the District of Columbia and elsewhere, for the purchase of law books and books of reference, for printing and binding, for the purchase, operation, and maintenance of passenger-carrying vehicles, and perform such acts, and prescribe such regulations, as he may deem proper to carry out the provisions of this Act.

SEC. 5. The Secretary of Agriculture shall establish an agency to be known as the "Soil Conservation Service," to exercise the powers conferred on him by this Act and may utilize the organization heretofore established for the purpose of administering those provisions of sections 202 and 203 of the National Industrial Recovery Act which relate to the prevention of soil erosion, together with such personnel thereof as the Secretary of Agriculture may determine, and all unexpended balances of funds heretofore allotted to said organization shall be available until June 30, 1937, and the Secretary of Agriculture shall assume all obligations incurred by said organization prior to transfer to the Department of Agriculture. Funds provided in H. J. Res. 117, "An Act making appropriation for relief purposes" (for soil erosion) shall be available for expenditure under the provisions of this Act; and in order that there may be proper coordination of erosion-control activities the Secretary of Agriculture may transfer to the agency created under this Act such functions, funds, personnel, and the property of other agencies in the Department of Agriculture as he may from time to time determine.

SEC. 6. There are hereby authorized to be appropriated for the purposes of this Act such sums as Congress may from time to time determine to be necessary.

SEC. 7. (a) It is hereby declared to be the policy of this Act also to secure, and the purposes of this Act shall also include, (1) preservation and improvement of soil fertility; (2) promotion of the economic use and conservation of land; (3) diminution of exploitation and wasteful and unscientific use of national soil resources; (4) the protection of rivers and harbors against the results of soil erosion in aid of maintaining the navigability of waters and water courses and in aid of flood control; and (5) reestablishment, at as rapid a rate as the Secretary of Agriculture determines to be practicable and in the general public interest, of the ratio between the purchasing power of the net income per person on farms and that of the income per person not on farms that prevailed during the five-year period August 1909–July 1914, inclusive, as determined from statistics available in the United States Department of Agriculture, and the maintenance of such ratio. The powers conferred under sections 7 to 14, inclusive, of this Act shall be used to assist voluntary action calculated to effectuate the purposes specified in this section. Such powers shall not be used to discourage the production of supplies of foods and fibers sufficient to maintain normal domestic human consumption as determined by the Secretary from the records of domestic human consumption in the years 1920 to 1929, inclusive, taking into consideration increased population, quantities of any commodity that were forced into domestic consumption by decline in exports during such period, current trends in domestic consumption and exports of particular commodities, and the quantities of substitutes available for domestic consumption within any general class of food commodities. In carrying out the purposes of this section due regard shall be given to the maintenance of a continuous and stable supply of agricultural commodities adequate to meet consumer demand at prices fair to both producers and consumers.

(b) The Secretary of Agriculture shall cooperate with States, in the execution of State plans to effectuate the purposes of this section, by making grants under this section to enable them to carry out such plans.

(c) Any State which submits to the Secretary, prior to such time and in such manner and form as the Secretary prescribes, a State plan to effectuate the purposes of this section shall be entitled to payments, as provided in this section, for the year to which such plan is applicable, if such plan is approved by the Secretary as provided in this section.

(d) No such plan shall be approved unless by its terms:

(1) It provides that the agency to administer the plan shall be such State agency as may be designated by the Secretary if such agency is authorized by the State, or such other State agency as is authorized by the State and approved by the Secretary;

(2) It provides for such methods of administration and such participation in the administration of the plan by county and community committees or associations of agricultural producers organized for such purpose, as the Secretary finds necessary for the effective administration of the plan; and

(3) It provides for the submission to the Secretary of such reports as he finds necessary to ascertain whether the plan is being carried out according to its terms. and for compliance with such requirements as the Secretary may prescribe to assure the correctness of and make possible the verification of such reports.

(e) Such plan shall be approved if the Secretary finds that there is a reasonable prospect that—

(1) Such substantial accomplishment in effectuating the purposes of this section will be brought about through the operation of such plan and the plans submitted by other States and

(2) The operation of such plan will result in as substantial a furtherance of such accomplishment as may reasonably be achieved through the action of such State.

(f) Upon approval of any State plan for any year the Secretary shall allocate to such State such sum (not in excess of the maximum amount fixed in pursuance of subsection (g) for such State for such year) as he finds necessary to carry out such plan for such year, and thereupon shall certify to the Secretary of the Treasury for payment to such agency of the State as the Secretary of Agriculture certifies is designated in the plan and the Secretary of the Treasury shall pay to such agency, one-fourth of the amount so allocated. The remainder of the amount so allocated shall be similarly certified and paid in such installments (payable prior to the end of the calendar year) as may be provided in the plan. No such installment shall be certified for payment if the Secretary of Agriculture finds that, prior to the due date of such installment, there has been a substantial failure by the State to carry out the plan according to its terms, or that the further operation of the plan according to its terms will not tend to effectuate the purposes of this section. No amount shall be certified for payment under any such installment in excess of the amount the Secretary finds necessary for the effective carrying out of the plan during the period to which the installment relates.

(g) On or before November 1 of each year, the Secretary shall apportion among the several States the funds which will be available for carrying out State plans during the next calendar year, and in determining the amount to be apportioned to each State, the Secretary shall take into consideration the acreage and value of the major soil depleting and major export crops produced in the respective States during a representative period and the acreage and productivity of land devoted to agricultural production (including dairy products) in the respective States during a representative period: *Provided, however,* That *any such apportionment of funds available for carrying out State plans during any year prior to 1942 may be made at any time prior to or during the year to which such plans relate.*[2] Notwithstanding the making of an apportionment to any State for any calendar year, the funds apportioned to any State for which no plan has been approved for such year, and any amount apportioned to any State which is not required to carry out an approved plan for such State for such year, shall be available for carrying out the provisions of sections 7 to 14, inclusive, of this act.

SEC. 8. (a) In order to carry out the purposes specified in section 7 (a) during the period necessary to afford a reasonable opportunity for legislative action by a sufficient number of States to assure the effectuation of such purposes by State action and in order to promote the more effective accomplishment of such purposes by State action thereafter, the Secretary shall exercise the powers conferred in this section during the period prior to *January 1, 1942.*[3] except with respect to farming operations commenced in any State after the

[2] The italicized words were substituted by sec. 1 (b) of Public, No. 170, 75th Cong., approved June 28, 1937, 50 Stat. 329, in lieu of the words "apportionments of funds available for carrying out the purposes specified in this section for the year 1936 may be made at any time during 1936, and apportionments for 1937 may be made at any time during 1937."

[3] The italicized words were substituted by sec. 1 (a) of Public, No. 170, 75th Cong., approved June 28, 1937, 50 Stat. 329, in lieu of the expression "January 1, 1938."

effective date of a State plan for such State approved pursuant to section 7. No such powers shall be exercised after *December 31, 1941*,[4] except with respect to payments or grants in connection with farming operations carried out prior to *January 1, 1942*.[3]

(b) Subject to the limitations provided in subsection (a) of this section, the Secretary shall have power to carry out the purposes specified in clauses (1), (2), (3), (4), and (5) of section 7 (a) by making payments or grants of other aid to agricultural producers, including tenants and sharecroppers, in amounts determined by the Secretary to be fair and reasonable in connection with the effectuation of such purposes during the year with respect to which such payments or grants are made, and measured by (1) their treatment or use of their land, or a part thereof, for soil restoration, soil conservation, or the prevention of erosion; (2) changes in the use of their land; (3) their equitable share, as determined by the Secretary, of the normal national production of any commodity or commodities required for domestic consumption; or (4) their equitable share, as determined by the Secretary, of the national production of any commodity or commodities required for domestic consumption and exports adjusted to reflect the extent to which their utilization of cropland on the farm conforms to farming practices which the Secretary determines will best effectuate the purposes specified in section 7 (a); or (5) any combination of the above. In arid or semiarid sections, (1) and (2) above shall be construed to cover water conservation and the beneficial use of water on individual farms, including measures to prevent run-off, the building of check dams and ponds, and providing facilities for applying water to the land. In determining the amount of any payment or grant measured by (1) or (2) the Secretary shall take into consideration the productivity of the land affected by the farming practices adopted during the year with respect to which such payment is made. In carrying out the provisions of this section in the continental United States, the Secretary is directed to utilize the services of local and State committees selected as hereinafter provided. The Secretary shall designate local administrative areas as units for administration of programs under this section. No such local area shall include more than one county or parts of different counties. Farmers within any such local administrative area, and participating or cooperating in programs administered within such area, shall elect annually from among their number a local committee of not more than three members for such area and shall also elect annually from among their number a delegate to a county convention for the election of a county committee. The delegates from the various local areas in the county shall, in a county convention, elect, annually, the county committee for the county which shall consist of three members who are farmers in the county. The local committee shall select a secretary and may utilize the county agricultural extension agent for such purpose. The county committee shall select a secretary who may be the county agricultural extension agent. If such county agricultural extension agent shall not have been elected secretary of such committee, he shall be ex officio a member of the county committee. The county agricultural extension agent shall not have the power to vote. In any county in which there is only one local committee the local committee shall also be the county committee. In each State there shall be a State committee for the State composed of not less than three or more than five farmers who are legal residents of the State and who are appointed by the Secretary. The State director of the Agricultural Extension Service shall be ex officio a member of such State committee. The ex officio members of the county and State committees shall be in addition to the number of members of such committees hereinbefore specified. The Secretary shall make such regulations as are necessary relating to the selection and exercise of the functions of the respective committees, and to the administration, through such committees, of such programs. In carrying out the provisions of this section, the Secretary—shall, as far as practicable, protect the interests of tenants and sharecroppers; is authorized to utilize the agricultural extension service and other approved agencies; shall accord such recognition and encouragement to producer-owned and producer-controlled cooperative associations as will be in harmony with the policy toward cooperative associations set forth in existing Acts of Congress and as will tend to promote efficient methods of marketing and distribution; shall not have power to acquire any

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[3] The italicized words were substituted by sec. 1 (a) of Public, No. 170, 75th Cong., approved June 28, 1937, 50 Stat. 329, in lieu of the expression "January 1, 1938."

[4] The italicized words were substituted by sec. 1 (a) of Public, No. 170, 75th Cong., approved June 28, 1937, 50 Stat. 329, in lieu of the expression "December 31, 1937."

land or any right or interest therein; shall, in every practicable manner, protect the interests of small producers; and shall in every practical way encourage and provide for soil-conserving and soil-rebuilding practices rather than the growing of soil-depleting crops. Rules and regulations governing payments or grants under this subsection shall be as simple and direct as possible, and, wherever practicable, they shall be classified on two basis: (a) Soil-depleting crops and practices, (b) soil-building crops and practices.[5]

(c) (1) In apportioning acreage allotments under this section in the case of wheat and corn, the National and State allotments and the allotments to counties shall be apportioned annually on the basis of the acreage seeded for the production of the commodity during the ten calendar years immediately preceding the calendar year in which the national acreage allotment is determined (plus, in applicable years, the acreage diverted under previous agricultural adjustment and conservation programs), with adjustments for abnormal weather conditions and trends in acreage during the applicable period.

(2) In the case of wheat, the allotment to any county shall be apportioned annually by the Secretary, through the local committees, among the farms within such county on the basis of tillable acres, crop-rotation practices, type of soil, and topography. Not more than 3 per centum of such county allotment shall be apportioned to farms on which wheat has not been planted during any of the three marketing years immediately preceding the marketing year in which the allotment is made.

(3) In the case of corn, the allotment to any county shall be apportioned annually by the Secretary, through the local committees, among the farms within such county on the basis of tillable acreage, type of soil, topography, and crop-rotation practices.

(4) Notwithstanding any other provision of this subsection, if, for any reason other than flood or drought, the acreage of wheat, cotton, corn, or rice planted on the farm is less than 80 per centum of the farm acreage allotment for such commodity for the purpose of payment, such farm acreage allotment shall be 25 per centum in excess of such planted acreage.

(5) In determining normal yield per acre ***for any county***[6] *under this section in the case of wheat or corn, the normal yield shall be the average yield per acre* ***therein***[7] *for such commodity during the ten calendar years immediately*

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[5] This italicized subsection was substituted by sec. 101 of the Agricultural Adjustment Act of 1938 in lieu of the following:

"(b) Subject to the limitations provided in subsection (a) of this section, the Secretary shall have power to carry out the purposes specified in clauses (1), (2), (3), and (4) of section 7 (a) by making payments or grants of other aid to agricultural producers, including tenants and sharecroppers, in amounts, determined by the Secretary to be fair and reasonable in connection with the effectuation of such purposes during the year with respect to which such payments or grants are made, and measured by (1) their treatment or use of their land, or a part thereof, for soil restoration, soil conservation, or the prevention of erosion, (2) changes in the use of their land, (3) a percentage of their normal production of any one or more agricultural commodities designated by the Secretary which equals that percentage of the normal national production of such commodity or commodities required for domestic consumption, or (4) any combination of the above. In determining the amount of any payment or grant measured by (1) or (2) the Secretary shall take into consideration the productivity of the land affected by the farming practices adopted during the year with respect to which such payment is made. In carrying out the provisions of this section, the Secretary shall, as far as practicable, protect the interests of tenants and sharecroppers. In carrying out the provisions of this section, the Secretary is authorized to utilize county and community committees of agricultural producers and the agricultural extension service, or other approved agencies. In carrying out the provisions of this section, the Secretary shall not have power to enter into any contract binding upon any producer or to acquire any land or any right or interest therein. In carrying out the provisions of this section, the Secretary shall, in every practicable manner, protect the interests of small producers. The Secretary, in administering this section, shall in every practical way encourage and provide for soil conserving and soil rebuilding practices rather than the growing of soil depleting commercial crops."

Sec. 105 of the Agricultural Adjustment Act of 1938, as amended by section 1 of the Act entitled "An Act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, provides as follows:

"SEC. 105. The amendments made by sections 101, 102, 103, and 104 shall first be effective with respect to farming operations carried out in the calendar year 1938. Notwithstanding such amendments, payments with respect to farming operations carried out in the calendar year 1938 and based upon any soil-depleting crop for which special acreage allotments are established shall be made at not less than 90 per centum of the rates announced by the Secretary prior to the enactment of this Act. Nothing contained herein shall require reconstituting, for 1938, any county or other local committee which has been constituted prior to February 1, 1938."

[6] The bold-face words were substituted, by sec. 16 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, in lieu of the words "on any farm."

[7] The bold-face word was substituted by sec. 16 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, in lieu of the word "thereon."

preceding the calendar year in which such yield is determined, adjusted for abnormal weather conditions and trends in yields. If for any reason there is no actual yield, or the data therefor are not available for any year, then an appraised yield for such year, determined in accordance with regulations of the Secretary, shall be used. If, on account of drought, flood, insect pests, plant disease, or other uncontrollable natural cause, the yield in any year of such ten-year period is less than 75 per centum of the average (computed without regard to such year), such year shall be eliminated in calculating the normal yield per acre.

(6) In determining normal yield per acre for any farm under this section in the case of wheat or corn, the normal yield shall be the average yield per acre thereon for such commodity during the ten calendar years immediately preceding the calendar year in which such yield is determined, adjusted for abnormal weather conditions and trends in yields. If for any such year the data are not available, or there is no actual yield, then the normal yield for the farm shall be appraised in accordance with regulations of the Secretary, taking into consideration abnormal weather conditions, the normal yield for the county, and the yield in years for which data are available.[8] [9]

(d) Any payment or grant of aid made under subsection (b) shall be conditioned upon the utilization of the land, with respect to which such payment is made, in conformity with farming practices which the Secretary finds tend to effectuate any one or more of the purposes specified in clause (1), (2), (3), (4), or (5) of section 7 (a).

Any payment made under subsection (b) with respect to any farm (except for lands which the Secretary determines should not be utilized for the harvesting of crops but should be permanently used for grazing purposes only) shall, if the number of cows kept on such farm, and in the county in which such farm is located, for the production of milk or products thereof (for market), exceeds the normal number of such cows, be further conditioned upon the utilization of the land, with respect to which such payment is made, so that soil-building and soil-conserving crops planted or produced on an acreage equal to the land normally used for the production of soil-depleting crops but, as a condition of such payment, not permitted to be so used, shall be used for the purpose of building and conserving the fertility of the soil, or for the production of agricultural commodities to be consumed on the farm, and not for market. Whenever it is determined that a county, as a whole, is in substantial compliance with the provisions of this paragraph, no payment shall be denied any individual farmer in the county by reason of this paragraph; and no payment shall be denied a farmer by reason of this paragraph unless it has been determined that the farmer has not substantially complied with the provisions of this paragraph. Whenever the Secretary finds that by reason of drought, flood, or other disaster, a shortage of feed exists in any area, he shall so declare, and to the extent and for the period he finds necessary to relieve such shortage, the operation of the condition provided in this paragraph shall be suspended in such area and, if necessary to relieve such shortage, in other areas defined by him. As used in this paragraph, the term "for market" means for disposition by sale, barter, or exchange, or by feeding (in any form) to dairy livestock which, or the products of which, are to be sold, bartered, or exchanged; and such term shall not include consumption on the farm. An agricultural commodity shall be deemed consumed on the farm if consumed by the farmer's family, employees, or household, or if fed to poultry or livestock other than dairy livestock on his farm; or if fed to dairy livestock on his farm and such dairy livestock, or the products thereof, are to be consumed by his family, employees, or household. Whenever the Secretary has reason to believe the income of producers of livestock (other than dairy cattle) or poultry in any area from such sources is being adversely affected by increases in the supply for market of such livestock or poultry, as the case may be, arising as a result of programs carried out under this Act, he shall make an investigation with respect to the existence of such facts. If, upon investigation, the Secretary

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[8] This subdivision (6) of subsec. (c) was added by sec. 17 of the act entitled "An act to amend the Agricultural Adjustment Act for 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938.

[9] This subsec. (c) was substituted, by sec. 101 of the Agricultural Adjustment Act of 1938, in lieu of the following:

"(c) Any payment or grant of aid made under subsection (b) shall be conditioned upon the utilization of the land, with respect to which such payment is made, in conformity with farming practices which the Secretary finds tend to effectuate the purposes specified in clause (1), (2), (3), or (4) of section 7 (a)."

For the effective date of this subsection reference is made to sec. 105 of the Agricultural Adjustment Act of 1938, as amended, set forth in full in footnote 5.

finds that the income of producers of such livestock or poultry, as the case may be, in any area from any such source is being adversely affected by such increases, he shall, as soon as practicable, make such provisions in the administration of this Act with respect to the use of diverted acres as he may find necessary to protect the interests of producers of such livestock or poultry in the affected area.[10]

(e) Payments made by the Secretary to farmers under subsection (b) shall be divided among the landlords, tenants, and sharecroppers of any farm, with respect to which such payments are made, in the same proportion that such landlords, enants, and sharecroppers are entitled to share in the proceeds of the agricultural commodity with respect to which such payments are made, except that payments based on soil-building or soil-conserving practices shall be divided in proportion to the extent which such landlords, tenants, and sharecroppers contribute to the carrying out of such practices. Such payments shall be paid by the Secretary directly to the landlords, tenants, or sharecroppers entitled thereto, and shall be computed at rates which will permit the Secretary to set aside out of the funds available for the making of such payments for each year an amount sufficient to permit the increases herein specified to be made within the limits of the funds so available. If with respect to any farm the total payment to any person for any year would be:

(1) Not more than $20, the payment shall be increased by 40 per centum;

(2) More than $20 but not more than $40, the payment shall be increased by $8, plus 20 per centum of the excess over $20;

(3) More than $40 but not more than $60, the payment shall be increased by $12, plus 10 per centum of the excess over $40;

(4) More than $60 but not more than $186, the payment shall be increased by $14; or

(5) More than $186 but less than $200, the payment shall be increased to $200.

In the case of payments of more than $1, the amount of the payment which shall be used to calculate the 40-, 20-, and 10-per-centum increases under clauses (1), (2), and (3) shall not include that part, if any, of the payment which is a fraction of a dollar.

Beginning with the calendar year 1939, no total payment for any year to any person under such subsection (b) shall exceed $10,000. In the case of payments made to any individual, partnership, or estate on account of performance on farms in different States, Territories, or possessions, the $10,000 limitation shall apply to the total of the payments for each State, Territory, or possession, for a year and not to the total of all such payments.[11]

(f) Any change between the landlord and the tenants or sharecroppers, with respect to any farm, that would increase over the previous year the amount of payments or grants of other aid under subsection (b) that would otherwise be made to any landlord shall not operate to increase such payment or grant to such landlord. Any reduction in the number of tenants below the average number of tenants on any farm during the preceding three years that would increase the payments or grants of other aid under such subsection that would otherwise be made to the landlord shall not hereafter operate to increase any such payment or grant to such landlord. Such limitations shall apply only if the county committee finds that the change or reduction is not justified and disapproves such change or reduction.[12]

(g) A payment which may be made to a farmer under this section may be assigned, without discount, by him in writing as security for cash or advances to finance making a crop. **Such assignment shall be signed by the farmer and witnessed by a member of the county or other local committee, or by the treasurer or the secretary of such committee, and filed with the county agent or the county committee. Such assignment shall include the statement that the assignment is not made to pay or secure any preexisting indebtedness.**[13]

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[10] This italicized subsection was added by sec. 101 of the Agricultural Adjustment Act of 1938. For the effective date of this italicized subsection reference is made to sec. 105 of the Agricultural Adjustment Act of 1938, as amended, set forth in full in footnote 5.

[11] This italicized subsection was added by sec. 102 of the Agricultural Adjustment Act of 1938. For the effective date of this subsection reference is made to sec. 105 of the Agricultural Adjustment Act of 1938, as amended, set forth in full in footnote 5.

[12] This italicized subsection was added by sec. 103 of the Agricultural Adjustment Act of 1938. For the effective date of this italicized subsection reference is made to sec. 105 of the Agricultural Adjustment Act of 1938, as amended, set forth in full in footnote 5.

[13] The bold-face words were substituted, by sec. 18 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th

This provision shall not authorize any suit against or impose any liability upon the Secretary or any disbursing agent if payment to the farmer is made without regard to the existence of any such assignment.[14]

SEC. 9. The Secretary is authorized to conduct surveys, investigations, and research relating to the conditions and factors affecting, and methods of accomplishing most effectively, the policy and purposes of section 7 (a). Notwithstanding any provision of existing law, the Secretary is authorized to make public such information as he deems necessary to carry out the provisions of this Act. *The Secretary shall transmit to the Congress a report, for the fiscal year ending June 30, 1937, and for each fiscal year thereafter, of the operations for such year under sections 7 to 14, inclusive, of this Act, which report shall include a statement of the expenditures made and obligations incurred, by classes and amounts.*[15]

SEC. 10. The term "agricultural commodity" as used in this Act means any such commodity and any regional or market classification, type or grade thereof.

SEC. 11. All funds available for carrying out this Act shall be available for allotment to the bureaus and offices of the Department of Agriculture and for transfer to such other agencies of the Federal or State Governments as the Secretary may request to cooperate or assist in carrying out this Act *And*[16] *for payments to committees or associations of producers in any region or regions to cover the estimated administrative expenses to be incurred by any such committee or association in cooperating in carrying out this Act: Provided, That the Secretary may prescribe that all or part of such estimated expenses of any such committee or association may be deducted pro rata from the payments or grants made to the members thereof: And provided further, That the Secretary may make such payments in advance of determination of performance.*[17]

SEC. 12. Whenever the Secretary finds that the exercise of the powers conferred in this section will tend to carry out the purpose specified in clause (5) of section 7 (a), or will tend to provide for and maintain a continuous and stable supply of agricultural commodities adequate to meet consumer demand at prices fair to both producers and consumers, or both, he shall use such part as he deems necessary of the sums appropriated to carry out this Act for the expansion of domestic and foreign markets or for seeking new or additional markets for agricultural commodities or the products thereof or for the removal or disposition of surpluses of such commodities or the products thereof.

SEC. 13. Notwithstanding the foregoing provisions of this Act, the Secretary is authorized and directed to provide for the execution by the Agricultural Adjustment Administration of such powers conferred upon him under sections 7 to 14, inclusive, of this Act as he deems may be appropriately exercised by such Administration, and for such purposes the provisions of law applicable to the appointment and compensation of persons employed by the Agricultural Adjustment Administration shall apply.

SEC. 14. The facts constituting the bases for any payment or grant or the amount thereof authorized to be made under section 7 or 8 hereof, when officially determined in conformity with rules or regulations prescribed by the Secretary of Agriculture, shall be reviewable only by the Secretary of Agriculture.

SEC. 15. To enable the Secretary of Agriculture to carry out the purposes of sections 7 and 8 there is hereby authorized to be appropriated for any fiscal year not exceeding $500,000,000.

The funds available for payments (after allowing for estimated administrative expenses, and not to exceed 5 percentum for payments with respect to range lands, noncrop pasture lands, and naval stores) shall be allocated among the commodities produced with respect to which payments or grants are to be computed. In allocating funds among the commodities the Secretary shall take into consideration and give equal weight to (1) the average acreages planted to

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Cong., approved April 7, 1938, in lieu of the following: "Such assignment shall be acknowledged by the farmer before the county agricultural extension agent and filed with such agent. The farmer shall file with such county agricultural extension agent an affidavit stating that the assignment is not made to pay or secure any preexisting indebtedness."

[14] This italicized subsection was added by sec. 103 of the Agricultural Adjustment Act of 1938. For the effective date of this italicized subsection reference is made to sec. 105 of the Agricultural Adjustment Act of 1938, as amended, set forth in full in footnote 5.

[15] The italicized words were added by sec. 2 of Public, No. 170, 75th Cong., approved June 28, 1937, 50 Stat. 329.

[16] So in original.

[17] The italicized words were added by Public Res. No. 131, 74th Cong., approved June 24, 1936.

the various commodities (including rotation pasture), for the ten years 1928 to 1937, adjusted for abnormal weather and other conditions, including acreage diverted from production under the agricultural adjustment and soil conservation programs; (2) the value at parity prices of the production from the allotted acreages of the various commodities for the year with respect to which the payment is made; (3) the average acreage planted to the various commodities during the ten years 1928 to 1937, including the acreage diverted from production under the agricultural adjustment and soil conservation programs, in excess of the allotted acreage for the year with respect to which the payment is made; and (4) the value based on average prices for the preceding ten years of the production of the excess acreage determined under item (3). The rate of payment used in making payments to the producers of each commodity shall be such that the estimated payments with respect to such commodity shall equal the amount of funds allocated to such commodity as herein provided. For the purpose of allocating funds and computing payments or grants the Secretary is authorized to consider as a commodity a group of commodities or a regional or market classification of a commodity. For the purpose of computing payments or grants the Secretary is authorized to use funds allocated to two or more commodities produced on farms of a designated regional or other classification to compute payments with respect to one of such commodities on such farms, and to use funds, in an amount equal to the estimated payments which would be made in any county, for making payments pursuant to a special program under section 8 approved by the Secretary for such county: Provided, That farm acreage allotments shall be made for wheat in 1938, but in determining compliance wheat shall be considered in the group with other crops for which special acreage allotments are not made.[18]

SEC. 16. The obligations incurred for the purpose of carrying out, for any calendar year, the provisions of sections 7 to 14, inclusive, of this Act shall not exceed $500,000,000.

SEC. 17.(a) This Act shall apply to the United States, the Territories of Alaska and Hawaii, and the possession of Puerto Rico, and as used in this Act, the term "State" includes Alaska, Hawaii, and Puerto Rico.

(b) This Act may be cited as the "Soil Conservation and Domestic Allotment Act."

PART II.—ANNOTATED COMPILATION OF AGRICULTURAL ADJUSTMENT ACT OF 1938, AS AMENDED [1]

An act to provide for the conservation of national soil resources and to provide an adequate and balanced flow of agricultural commodities in interstate and foreign commerce, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Agricultural Adjustment Act of 1938."

DECLARATION OF POLICY

SEC. 2. It is hereby declared to be the policy of Congress to continue the Soil Conservation and Domestic Allotment Act, as amended, for the purpose of conserving national resources, preventing the wasteful use of soil fertility, and of preserving, maintaining, and rebuilding the farm and ranch land resources in the national public interest; to accomplish these purposes through the encouragement of soil-building and soil-conserving crops and practices; to assist in the marketing of agricultural commodities for domestic consumption and for export; and to regulate interstate and foreign commerce in cotton, wheat, corn, tobacco, and rice to the extent necessary to provide an orderly, adequate, and balanced flow of such commodities in interstate and foreign commerce through storage of reserve supplies, loans, marketing quotas, assisting farmers to obtain, insofar as practicable, parity prices for such commodities and parity of income, and assisting consumers to obtain an adequate and steady supply of such commodities at fair prices.

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[18] The italicized words were added by sec. 104 of the Agricultural Adjustment Act of 1938. For the effective date of this italicized provision reference is made to sec. 105 of the Agricultural Adjustment Act of 1938, as amended, set forth in full in footnote 5.

[1] Public, No. 430, 75th Cong., approved February 16, 1938, 52 Stat. 31.

TITLE I—AMENDMENTS TO SOIL CONSERVATION AND DOMESTIC ALLOTMENT ACT [2]

TITLE II—ADJUSTMENT IN FREIGHT RATES, NEW USES AND MARKETS, AND DISPOSITION OF SURPLUSES

ADJUSTMENTS IN FREIGHT RATES FOR FARM PRODUCTS

SEC. 201. (a) The Secretary of Agriculture is authorized to make complaint to the Interstate Commerce Commission with respect to rates, charges, tariffs, and practices relating to the transportation of farm products, and to prosecute the same before the Commission. Before hearing or disposing of any complaint (filed by any person other than the Secretary) with respect to rates, charges, tariffs, and practices relating to the transportation of farm products, the Commission shall cause the Secretary to be notified, and, upon application by the Secretary, shall permit the Secretary to appear and be heard.

(b) If such rate, charge, tariff, or practice complained of is one affecting the public interest, upon application by the Secretary, the Commission shall make the Secretary a party to the proceeding. In such case the Secretary shall have the rights of a party before the Commission and the rights of a party to invoke and pursue original and appellate judicial proceedings involving the Commission's determination. The liability of the Secretary in any such case shall extend only to liability for court costs.

(c) For the purposes of this section, the Interstate Commerce Commission is authorized to avail itself of the cooperation, records, services, and facilities of the Department of Agriculture.

(d) The Secretary is authorized to cooperate with and assist cooperative associations of farmers making complaint to the Interstate Commerce Commission with respect to rates, charges, tariffs, and practices relating to the transportation of farm products.

NEW USES AND NEW MARKETS FOR FARM COMMODITIES

SEC. 202. (a) The Secretary is hereby authorized and directed to establish, equip, and maintain four regional research laboratories, one in each major farm producing area, and, at such laboratories, to conduct researches into and to develop new scientific, chemical, and technical uses and new and extended markets and outlets for farm commodities and products and byproducts thereof. Such research and development shall be devoted primarily to those farm commodities in which there are regular or seasonal surpluses, and their products and byproducts.

(b) For the purposes of subsection (a), the Secretary is authorized to acquire land and interests therein, and to accept in the name of the United States donations of any property, real or personal, to any laboratory established pursuant to this section, and to utilize voluntary or uncompensated services at such laboratories. Donations to any one of such laboratories shall not be available for use by any other of such laboratories.

(c) In carrying out the purposes of subsection (a), the Secretary is authorized and directed to cooperate with other departments or agencies of the Federal Government, States, State agricultural experiment stations, and other State agencies and institutions, counties, municipalities, business or other organizations, corporations, associations, universities, scientific societies, and individuals, upon such terms and conditions as he may prescribe.

(d) To carry out the purposes of subsection (a), the Secretary is authorized to utilize in each fiscal year, beginning with the fiscal year beginning July 1, 1938, a sum not to exceed $4,000,000 of the funds appropriated pursuant to section 391 of this Act, or section 15 of the Soil Conservation and Domestic Allotment Act, as amended, for such fiscal year. The Secretary shall allocate one-fourth of such sum annually to each of the four laboratories established pursuant to this section.

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[2] This title contains amendments to the Soil Conservation and Domestic Allotment Act, as amended. These amendments are set forth in the Annotated Compilation of the Soil Conservation and Domestic Allotment Act, as amended, Part I of this document, and, therefore, the provisions of this title are omitted from the Annotated Compilation of the Agricultural Adjustment Act of 1938, as amended, Part II of this document.

(e) The Secretary shall make a report to Congress at the beginning of each regular session of the activities of, expenditures by, and donations to the laboratories established pursuant to subsection (a).

(f) There is hereby allocated to the Secretary of Commerce for each fiscal year, beginning with the fiscal year beginning July 1, 1938, out of funds appropriated for such fiscal year pursuant to section 391 of this Act, or section 15 of the Soil Conservation and Domestic Allotment Act, as amended, the sum of $1,000,000 to be expended for the promotion of the sale of farm commodities and products thereof in such manner as he shall direct. Of the sum allocated under this subsection to the Secretary of Commerce for the fiscal year beginning July 1, 1938, $100,000 shall be devoted to making a survey and investigation of the cause or causes of the reduction in exports of agricultural commodities from the United States, in order to ascertain methods by which the sales in foreign countries of basic agricultural commodities produced in the United States may be increased.

(g) It shall be the duty of the Secretary to use available funds to stimulate and widen the use of all farm commodities in the United States and to increase in every practical way the flow of such commodities and the products thereof into the markets of the world.

SEC. 203. Section 32, as amended, of the Act entitled "An Act to amend the Agricultural Adjustment Act, and for other purposes," approved August 24, 1935, is amended by striking out ": *Provided further*, That no part of the funds appropriated by this section shall be used for the payment of benefits in connection with the exportation of unmanufactured[3] cotton", and is further amended by adding at the end thereof the following: "Notwithstanding any other provision of this section, the amount that may be devoted, during any fiscal year after June 30, 1939, to any one agricultural commodity or the products thereof in such fiscal year, shall not exceed 25 per centum of the funds available under this section for such fiscal year."

CONTINUATION OF FEDERAL SURPLUS COMMODITIES CORPORATION

SEC. 204. The Act entitled "An Act to extend the time for purchase and distribution of surplus agricultural commodities for relief purposes and to continue the Federal Surplus Commodities Corporation," approved June 28, 1937 (Public, Numbered 165, Seventy-fifth Congress), is amended by striking out "continued, until June 30, 1939," and inserting in lieu thereof "continued, until June 30, 1942,". The Federal Surplus Commodities Corporation shall submit to Congress on the first day of each regular session an annual report setting forth a statement of the activities, receipts, and expenditures of the Corporation during the previous fiscal year.

TITLE III—LOANS, PARITY PAYMENTS, CONSUMER SAFEGUARDS, AND MARKETING QUOTAS

SUBTITLE A—DEFINITIONS, LOANS, PARITY PAYMENTS, AND CONSUMER SAFEGUARDS

DEFINITIONS

SEC. 301. (a) GENERAL DEFINITIONS.—For the purposes of this title and the declaration of policy—

(1) "Parity," as applied to prices for any agricultural commodity, shall be that price for the commodity which will give to the commodity a purchasing power with respect to articles that farmers buy equivalent to the purchasing power of such commodity in the base period; and, in the case of all commodities for which the base period is the period August 1909 to July 1914, which will also reflect current interest payments per acre on farm indebtedness secured by real estate, tax payments per acre on farm real estate, and freight rates, as contrasted with such interest payments, tax payments, and freight rates during the base period. The base period in the case of all agricultural commodities except tobacco shall be the period August 1909 to July 1914, and, in the case of tobacco, shall be the period August 1919 to July 1929.

(2) "Parity," as applied to income, shall be that per capita net income of individuals on farms from farming operations that bears to the per capita

[3] So in original.

net income of individuals not on farms the same relation as prevailed during the period from August 1909 to July 1914.

(3) The term "interstate and foreign commerce" means sale, marketing, trade, and traffic between any State or Territory or the District of Columbia or Puerto Rico, and any place outside thereof; or between points within the same State or Territory or within the District of Columbia or Puerto Rico, through any place outside thereof; or within any Territory or within the District of Columbia or Puerto Rico.

(4) The term "affect interstate and foreign commerce" means, among other things, in such commerce, or to burden or obstruct such commerce or the free and orderly flow thereof; or to create or tend to create a surplus of any agricultural commodity which burdens or obstructs such commerce or the free and orderly flow thereof.

(5) The term "United States" means the several States and Territories and the District of Columbia and Puerto Rico.

(6) The term "State" includes a Territory and the District of Columbia and Puerto Rico.

(7) The term "Secretary" means the Secretary of Agriculture, and the term "Department" means the Department of Agriculture.

(8) The term "person" means an individual, partnership, firm, joint-stock company, corporation, association, trust, estate, or any agency of a State.

(9) The term "corn" means field corn.

(b) DEFINITIONS APPLICABLE TO ONE OR MORE COMMODITIES.—For the purposes of this title—

(1) (A) "Actual production" as applied to any acreage of corn means the number of bushels of corn which the local committee determines would be harvested as grain from such acreage if all the corn on such acreage were so harvested. In case of a disagreement between the farmer and the local committee as to the actual production of the acreage of corn on the farm, or in case the local committee determines that such actual production is substantially below normal, the local committee, in accordance with regulations of the Secretary, shall weigh representative samples of ear corn taken from the acreage involved, make proper deductions for moisture content, and determine the actual production of such acreage on the basis of such samples.

(B) "Actual production" of any number of acres of cotton on a farm means the actual average yield for the farm times such number of acres.

(2) "Bushel" means in the case of ear corn that amount of ear corn, including not to exceed 15½ per centum of moisture content, which weighs seventy pounds, and in the case of shelled corn, means that amount of shelled corn including not to exceed 15½ per centum of moisture content, which weighs fifty-six pounds.

(3) (A) "Carry-over," in the case of corn and rice, for any marketing year shall be the quantity of the commodity on hand in the United States at the beginning of such marketing year, which was produced in the United States prior to the beginning of the calendar year then current.

(B) "Carry-over" of cotton for any marketing year shall be the quantity of cotton on hand either within or without the United States at the beginning of such marketing year, which was produced in the United States prior to the beginning of the calendar year then current.

(C) "Carry-over" of tobacco for any marketing year shall be the quantity of such tobacco on hand in the United States at the beginning of such marketing year, which was produced in the United States prior to the beginning of the calendar year then current, except that in the case of cigar-filler and cigar-binder tobacco the quantity of type 46 on hand and theretofore produced in the United States during such calendar year shall also be included.

(D) "Carry-over" of wheat, for any marketing year shall be the quantity of wheat on hand in the United States at the beginning of such marketing year, not including any wheat which was produced in the United States during the calendar year then current, and not including any wheat held by the Federal Crop Insurance Corporation under Title V.

(4) (A) "Commercial corn-producing area" shall include all counties in which the average production of corn (excluding corn used as silage) during the ten calendar years immediately preceding the calendar year for which such area is determined, after adjustment for abnormal weather conditions, is four hundred and fifty bushels or more per farm and four bushels or more for each acre of farm land in the county.

(B) Whenever prior to February 1 of any calendar year the Secretary has reason to believe that any county which is not included in the commercial corn-

producing area determined pursuant to the provisions of subparagraph (A), but which borders upon one of the counties in such area, or that any minor civil division in a county bordering on such area, is producing (excluding corn used for silage) an average of at least four hundred and fifty bushels of corn per farm and an average of at least four bushels for each acre of farm land in the county or in the minor civil division, as the case may be, he shall cause immediate investigation to be made to determine such fact. If, upon the basis of such investigation, the Secretary finds that such county or minor civil division is likely to produce corn in such average amounts during such calendar year, he shall proclaim such determination, and, commencing with such calendar year, such county shall be included in the commercial corn-producing area. In the case of a county included in the commercial corn-producing area pursuant to this subparagraph, whenever prior to February 1 of any calendar year the Secretary has reason to believe that facts justifying the inclusion of such county are not likely to exist in such calendar year, he shall cause an immediate investigation to be made with respect thereto. If, upon the basis of such investigation the Secretary finds that such facts are not likely to exist in such calendar year, he shall proclaim such determination, and commencing with such calendar year, such county shall be excluded from the commercial corn-producing area.

(5) "Farm consumption" of corn means consumption by the farmer's family, employees, or household, or by his work stock; or consumption by poultry or livestock on his form if such poultry or livestock, or the products thereof, are consumed or to be consumed by the farmer's family, employees, or household.

(6) (A) "Market," in the case of cotton, wheat, and tobacco, means to dispose of by sale, barter, or exchange, but, in the case of wheat, does not include disposing of wheat as premium to the Federal Crop Insurance Corporation under Title V.

(B) "Market," in the case of corn, means to dispose of by sale, barter, or exchange, or by feeding (in any form) to poultry or livestock which, or the products of which, are sold, bartered, or exchanged, or to be so disposed of.

(C) "Market," in the case of rice, means to dispose of by sale, barter, or exchange of rice used or to be used for human consumption.

(D) "Marketed," "marketing," and "for market" shall have corresponding meanings to the term "market" in the connection in which they are used.

(7) "Marketing year" means, in the case of the following commodities, the period beginning on the first and ending with the second date specified below:

Corn, October 1–September 30;
Cotton, August 1–July 31;
Rice, August 1–July 31;
Tobacco (flue-cured), July 1–June 30;
Tobacco (other than flue-cured), October 1–September 30;
Wheat, July 1–June 30.

(8) "National average yield" as applied to cotton or wheat shall be the national average yield per acre of the commodity during the ten calendar years in the case of wheat, and during the five calendar years in the case of cotton, preceding the year in which such national average yield is used in any computation authorized in this title, adjusted for abnormal weather conditions and, in the case of wheat but not in the case of cotton, for trends in yields.

(9) "Normal production" as applied to any number of acres of corn, cotton, or wheat means the normal yield for the farm times such number of acres.

(10) (A) "Normal supply" in the case of corn, cotton, rice, and wheat shall be a normal year's domestic consumption and exports of the commodity, plus 7 per centum in the case of corn, 40 per centum in the case of cotton, 10 per centum in the case of rice, and 15 per centum in the case of wheat, of a normal year's domestic consumption and exports, as an allowance for a normal carry-over.

(B) The "normal supply" of tobacco shall be a normal year's domestic consumption and exports plus 175 per centum of a normal year's domestic consumption and 65 per centum of a normal year's exports as an allowance for a normal carry-over.

(11) (A) "Normal year's domestic consumption," in the case of corn and wheat, shall be the yearly average quantity of the commodity, wherever produced, that was consumed [4] in the United States during the ten marketing years immediately preceding the marketing year in which such consumption is determined, adjusted for current trends in such consumption.

[4] So in original.

(B) "Normal year's domestic consumption," in the case of cotton and tobacco, shall be the yearly average quantity of the commodity produced in the United States that was consumed in the United States during the ten marketing years immediately preceding the marketing year in which such consumption is determined, adjusted for current trends in such consumption.

(C) "Normal year's domestic consumption," in the case of rice, shall be the yearly average quantity of rice produced in the United States that was consumed in the United States during the five marketing years immediately preceding the marketing year in which such consumption is determined, adjusted for current trends in such consumption.

(12) "Normal year's exports" in the case of corn, cotton, rice, tobacco, and wheat shall be the yearly average quantity of the commodity produced in the United States that was exported from the United States during the ten marketing years (or, in the case of rice, the five marketing years) immediately preceding the marketing year in which such exports are determined, adjusted for current trends in such exports.

(13) (A) "Normal yield" for any *county*,[5] in the case of corn, shall be the average yield per acre of corn for the *county*[5] during the ten calendar years immediately preceding the year in which such normal yield is used in computing any farm marketing quota or adjustment thereof, adjusted for abnormal weather conditions and trends in yields.

(B) "Normal yield" for any *county*,[6] in the case of wheat or cotton, shall be the average yield per acre of wheat or cotton for the *county*[6] adjusted for abnormal weather conditions, and, in the case of wheat but not in the case of cotton, for trends in yields, during the ten calendar years in the case of wheat, and five calendar years in the case of cotton, immediately preceding the year with respect to which such normal yield is used in any computation authorized under this title.

(C) In applying subparagraph (A) or (B), if for any such year the data are not available, or there is no actual yield, an appraised yield for such year, determined in accordance with regulations issued by the Secretary, shall be used as the actual yield for such year. In applying such subparagraphs, if, on account of drought, flood, insect pests, plant disease, or other uncontrollable natural cause, the yield in any year of such ten-year period or five-year period, as the case may be, is less than 75 per centum of the average (computed without regard to such year) such year shall be eliminated in calculating the normal yield per acre.

(D) "Normal yield" per acre of rice for any land planted to rice in any year shall be the average yield per acre thereof during the five calendar years immediately preceding the calendar year for which such normal yield is determined. If, for any reason, there is no actual yield or the data therefor are not available for any year, then an appraised yield for such year, determined in accordance with the regulations of the Secretary, shall be used. If the average of the normal yields for all lands planted to rice in any year in the State (weighted by the acreage allotments therein) exceeds the average yield per acre for the State during the period used in determining normal yields, the normal yields for such lands in the State shall be reduced pro rata so that the average of such normal yields shall not exceed such State average yield.

(E) "Normal yield" for any farm, in the case of corn, wheat, or cotton, shall be the average yield per acre of corn, wheat, or cotton, as the case may be, for the farm, adjusted for abnormal weather conditions and, in the case of corn and wheat, but not in the case of cotton, for trends in yields, during the ten calendar years in the case of corn and wheat, and five calendar years in the case of cotton, immediately preceding the year with respect to which such normal yield is used in any computation authorized under this title. If for any such year the data are not available or there is no actual yield, then the normal yield for the farm shall be appraised in accordance with regulations of the Secretary, taking into consideration abnormal weather conditions, the normal yield for the county, and the yield in years for which data are available.[7]

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[5] The italicized word was substituted, by sec. 2 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, in lieu of the word "farm."

[6] The italicized word was substituted, by sec. 3 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, in lieu of the word "farm."

[7] This paragraph (E) of subsec. (b) (13) was added by sec. 4 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938.

(14) (A) "Reserve supply level," in the case of corn, shall be a normal year's domestic consumption and exports of corn plus 10 per centum of a normal year's domestic consumption and exports, to insure a supply adequate to meet domestic consumption and export needs in years of drought, flood, or other adverse conditions, as well as in years of plenty.

(B) "Reserve supply level" of tobacco shall be the normal supply plus 5 per centum thereof, to insure a supply adequate to meet domestic consumption and export needs in years of drought, flood, or other adverse conditions, as well as in years of plenty.

(15) "Tobacco" means each one of the kinds of tobacco listed below comprising the types specified as classified in Service and Regulatory Announcement Numbered 118 of the Bureau of Agricultural Economics of the Department:

Flue-cured tobacco, comprising types 11, 12, 13, and 14;

Fire-cured and dark air-cured tobacco, comprising types 21, 22, 23, 24, 35, 36, and 37;

Burley tobacco, comprising type 31;

Maryland tobacco, comprising type 32;

Cigar-filler and cigar-binding tobacco, comprising types 42, 43, 44, 45, 46, 51, 52, 53, 54, and 55;

Cigar-filler tobacco, comprising type 41.

The provisions of this title shall apply to each of such kinds of tobacco severally.

(16) (A) "Total supply" of corn, cotton, rice, and wheat for any marketing year shall be the carry-over of the commodity for such marketing year plus the estimated production of the commodity in the United States during the calendar year in which such marketing year begins.

(B) "Total supply" of tobacco for any marketing year shall be the carry-over at the beginning of such marketing year plus the estimated production thereof in the United States during the calendar year in which such marketing year begins, except that the estimated production of type 46 tobacco during the marketing year with respect to which the determination is being made shall be used in lieu of the estimated production of such type during the calendar year in which such marketing year begins in determining the total supply of cigar-filler and cigar-binding tobacco.

(c) The latest available statistics of the Federal Government shall be used by the Secretary in making the determinations required to be made by the Secretary under this Act.

LOANS ON AGRICULTURAL COMMODITIES

SEC. 302. (a) The Commodity Credit Corporation is authorized, upon recommendation of the Secretary and with the approval of the President, to make available loans on agricultural commodities (including dairy products). Except as otherwise provided in this section, the amount, terms, and conditions of such loans shall be fixed by the Secretary, subject to the approval of the Corporation and the President.

(b) The Corporation is directed to make available to cooperators loans upon wheat during any marketing year beginning in a calendar year in which the farm price of wheat on June 15 *or at any time thereafter during such marketing year;*[8] is below 52 per centum of the parity price *at any such time*[9] or the July crop estimate for wheat is in excess of a normal year's domestic consumption and exports, at rates not less than 52 per centum and not more than 75 per centum of the parity price of wheat at the beginning of the marketing year. In case marketing quotas for wheat are in effect in any marketing year, the Corporation is directed to make available, during such marketing year, to noncooperators, loans upon wheat at 60 per centum of the rate applicable to cooperators. A loan on wheat to a noncooperator shall be made only on so much of his wheat as would be subject to penalty if marketed.

(c) The Corporation is directed to make available to cooperators loans upon cotton during any marketing year beginning in a calendar year in which the

[8] The italicized words and the semicolon were added by sec. 502 (a) of the Price Adjustment Act of 1938, Title V of Public Res. No. 122, 75th Cong., approved June 21, 1938.

[9] The italicized words were substituted by sec. 502 (a) of the Price Adjustment Act of 1938, Public Res. No. 122, 75th Cong., approved June 21, 1938, in lieu of the words "on such date."

average price on August 1 *or at any time thereafter during such marketing year*[10] of seven-eighths Middling spot cotton on the ten markets designated by the Secretary is below 52 per centum of the parity price of cotton *at any such time*[11] or the August crop estimate for cotton is in excess of a normal year's domestic consumption and exports, at rates not less than 52 per centum and not more than 75 per centum of the parity price of cotton as of the beginning of the marketing year. In case marketing quotas for cotton are in effect in any marketing year, the Corporation is directed to make available, during such marketing year, to noncooperators, loans upon cotton at 60 per centum of the rate applicable to cooperators. A loan on cotton to a noncooperator shall be made only on so much of his cotton as would be subject to penalty if marketed.

(d) The Corporation is directed to make available loans upon corn during any marketing year beginning in the calendar year in which the November crop estimate for corn is in excess of a normal year's domestic consumption and exports, or in any marketing year when on November 15 *or at any time thereafter during such marketing year*[12] the farm price of corn is below 75 per centum of the parity price, at the following rates:

75 per centum of such parity price if such estimate does not exceed a normal year's consumption and exports and the farm price of corn is below 75 per centum of the parity price on November 15 *or at any time thereafter during such marketing year*;[12]

70 per centum of such parity price if such estimate exceeds a normal year's domestic consumption and exports by not more than 10 per centum;

65 per centum of such parity price if such estimate exceeds a normal year's domestic consumption and exports by more than 10 per centum and not more than 15 per centum;

60 per centum of such parity price if such estimate exceeds a normal year's domestic consumption and exports by more than 15 per centum and not more than 20 per centum;

55 per centum of such parity price if such estimate exceeds a normal year's domestic consumption and exports by more than 20 per centum and not more than 25 per centum;

52 per centum of such parity price if such estimate exceeds a normal year's domestic consumption and exports by more than 25 per centum.

Loans shall be made to cooperators in the commercial corn-producing area at the applicable rate of the above schedule. Loans shall be made to noncooperators within such commercial corn-producing area but only during a marketing year in which farm marketing quotas are in effect and only on corn stored under seal pursuant to section 324, and the rate of such loans shall be 60 per centum of the applicable rate under the above schedule. Loans shall be made to cooperators outside such commercial corn-producing area, and the rate of such loans shall be 75 per centum of the applicable rate under the above schedule.

(e) The rates of loans under subsections (b), (c), and (d) on wheat, cotton, and corn not of standard grade, type, staple, or quality shall be increased or decreased in relation to the rates above provided by such amounts as the Secretary prescribes as properly reflecting differences from standard in grade, type, staple, and quality.

(f) For the purposes of subsections (b), (c), and (d), a cooperator shall be a producer on whose farm the acreage planted to the commodity for the crop with respect to which the loan is made does not exceed the farm acreage allotment for the commodity under this title, or, in the case of loans upon corn to a producer outside the commercial corn-producing area, a producer on whose farm the acreage planted to soil-depleting crops does not exceed the farm acreage allotment for soil-depleting crops for the year in which the loan is made under the Soil Conservation and Domestic Allotment Act, as amended. For the purposes of this subsection a producer shall not be deemed to have exceeded his farm acreage allotment unless such producer knowingly exceeded his farm acreage allotment.

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[10] The italicized words were added by sec. 502 (b) of the Price Adjustment Act of 1938, Title V of Public Res. No. 122, 75th Cong., approved June 21, 1938.

[11] The italicized words were substituted by sec. 502 (b) of the Price Adjustment Act of 1938, Public Res. No. 122, 75th Cong., approved June 21, 1938, in lieu of the words "on such date."

[12] The italicized words were added by sec. 502 (c) of the Price Adjustment Act of 1938, Public Res. No. 122, 75th Cong., approved June 21, 1938.

(g) Notwithstanding any other provision of this section, if the farmers producing cotton, wheat, corn, or rice indicate by vote in a referendum carried out pursuant to the provisions of this title that marketing quotas with respect to such commodity are opposed by more than one-third of the farmers voting in such referendum, no loan shall be made pursuant to this section with respect to the commodity during the period from the date on which the results of the referendum are proclaimed by the Secretary until the beginning of the second succeeding marketing year for such commodity. This subsection shall not limit the availability or renewal of any loan previously made.

(h) No producer shall be personally liable for any deficiency arising from the sale of the collateral securing any loan under this section unless such loan was obtained through fraudulent representations by the producer.

(i) In carrying out this section the Corporation is directed, with the consent of the Secretary, to utilize the services, facilities, and personnel of the Department.

PARITY PAYMENTS

SEC. 303. If and when appropriations are made therefor, the Secretary is authorized and directed to make payments to producers of corn, wheat, cotton, rice, or tobacco, on their normal production of such commodities in amounts which, together with the proceeds thereof, will provide a return to such producers which is as nearly equal to parity price as the funds so made available will permit. All funds available for such payments with respect to these commodities shall, unless otherwise provided by law, be apportioned to these commodities in proportion to the amount by which each fails to reach the parity income. Such payments shall be in addition to and not in substitution for any other payments authorized by law.

CONSUMER SAFEGUARDS

SEC. 304. The powers conferred under this act shall not be used to discourage the production of supplies of foods and fibers sufficient to maintain normal domestic human consumption as determined by the Secretary from the records of domestic human consumption in the years 1920 to 1929, inclusive, taking into consideration increased population, quantities of any commodity that were forced into domestic consumption by decline in exports during such period, current trends in domestic consumption and exports of particular commodities, and the quantities of substitutes available for domestic consumption within any general class of food commodities. In carrying out the purposes of this act it shall be the duty of the Secretary to give due regard to the maintenance of a continuous and stable supply of agricultural commodities from domestic production adequate to meet consumer demand at prices fair to both producers and consumers.

SUBTITLE B—MARKETING QUOTAS

PART I.—MARKETING QUOTAS—TOBACCO

LEGISLATIVE FINDING

SEC. 311 (a) The marketing of tobacco constitutes one of the great basic industries of the United States with ramifying activities which directly affect interstate and foreign commerce at every point, and stable conditions therein are necessary to the general welfare. Tobacco produced for market is sold on a Nation-wide market and, with its products, moves almost wholly in interstate and foreign commerce from the producer to the ultimate consumer. The farmers producing such commodity are subject in their operations to uncontrollable natural causes, are widely scattered throughout the Nation, in many cases such farmers carry on their farming operations on borrowed money or leased lands, and are not so situated as to be able to organize effectively, as can labor and industry through unions and corporations enjoying Government protection and sanction. For these reasons, among others, the farmers are unable without Federal assistance to control effectively the orderly marketing of such commodity with the result that abnormally excessive supplies thereof are produced and dumped indiscriminately on the Nation-wide market.

(b) The disorderly marketing of such abnormally excessive supplies affects, burdens, and obstructs interstate and foreign commerce by (1) materially affecting the volume of such commodity marketed therein, (2) disrupting the

orderly marketing of such commodity therein, (3) reducing the price for such commodity with consequent injury and destruction of interstate and foreign commerce in such commodity, and (4) causing a disparity between the prices for such commodity in interstate and foreign commerce and industrial products therein, with a consequent diminution of the volume of interstate and foreign commerce in industrial products.

(c) Whenever an abnormally excessive supply of tobacco exists, the marketing of such commodity by the producers thereof directly and substantially affects interstate and foreign commerce in such commodity and its products, and the operation of the provisions of this Part becomes necessary and appropriate in order to promote, foster, and maintain an orderly flow of such supply in interstate and foreign commerce.

NATIONAL MARKETING QUOTA

SEC. 312. (a) Whenever, on the 15th day of November of any calendar year, the Secretary finds that the total supply of tobacco as of the beginning of the marketing year then current exceeds the reserve supply level therefor, the Secretary shall proclaim the amount of such total supply, and, beginning on the first day of the marketing year next following and continuing throughout such year, a national marketing quota shall be in effect for the tobacco marketed during such marketing year. The Secretary shall also determine and specify in such proclamation the amount of the national marketing quota in terms of the total quanity of tobacco which may be marketed, which will make available during such marketing year a supply of tobacco equal to the reserve supply level. Such proclamation shall be made not later than the 1st day of December in such year.[13]

(b) Whenever in the case of burley tobacco, and fire-cured and dark air-cured tobacco, respectively, the total supply proclaimed pursuant to the provisions of subsection (a) of this section exceeds the reserve supply level by more than 5 per centum and a national marketing quota is not in effect for such tobacco during the marketing year then current, a national marketing quota shall also be in effect for such tobacco marketed during the period from the date of such proclamation to the end of such current marketing year, and the Secretary shall determine and shall specify in such proclamation the amount of such national marketing quota in terms of the total quantity which may be marketed, which will make available during such current marketing year a supply of tobacco equal to the reserve supply level. The provisions of this subsection shall not be effective prior to the beginning of the marketing year beginning in the calendar year 1938.

(c) Within thirty days after the date of the issuance of the proclamation specified in subsection (a) of this section, the Secretary shall conduct a referendum of farmers who were engaged in production of the crop of tobacco harvested prior to the holding of the referendum to determine whether such farmers are in favor of or opposed to such quota. If in the case of burley tobacco, or fire-cured and dark air-cured tobacco, respectively, farmers would be subject to a national quota for the next succeeding marketing year pursuant to the provisions of subsection (a) of this section, and also to a national marketing quota for the current marketing year pursuant to the provisions of subsection (b) of this section, the referendum shall provide for voting with respect to each such quota. If more than one-third of the farmers voting in the referendum oppose such quota, the Secretary shall, prior to the 1st day of January, proclaim the result of the referendum and such quota shall not be effective thereafter.[13]

(d) In connection with the determination and proclamation of any marketing quota for the 1938–1939 marketing year, the determination by the Secretary pursuant to subsection (a) of this section shall be made and proclaimed within fifteen days following the date of the enactment of this Act, and the proclamation of the Secretary pursuant to subsection (c) of this section shall be made within forty-five days following the date of the enactment of this Act.

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[13] Sec. 19 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, provides as follows:

"The proclamation heretofore issued by the Secretary of Agriculture under sections 312 (a), 327, 328, and 345 of the Agricultural Adjustment Act of 1938 shall be effective as provided in said sections, and no provision of any amendment made by this Act shall be construed as requiring any further action under section 312 (c) or 347 of the Agricultural Adjustment Act of 1938 with respect to marketing years beginning in 1938."

(e) Marketing quotas shall not be in effect with respect to cigar-filler tobacco comprising type 41 during the marketing year beginning in 1938 or the marketing year beginning in 1939.

(f) Notwithstanding any other provisions of this Act, the Secretary shall, within fifteen days after the enactment of this subsection (f), proclaim the amount of the total supply of burley tobacco for the marketing year therefor beginning October 1, 1937, and a national marketing quota shall be in effect for burley tobacco marketed during the marketing year for such tobacco beginning October 1, 1938. The Secretary shall also determine and specify in such proclamation the amount of such national marketing quota in terms of the total quantity of such tobacco which may be marketed, which will make available during the marketing year beginning October 1, 1938, a supply of such tobacco equal to the reserve supply level. The referendum with respect to such quota, pursuant to subsection (c) of this section, shall be held and the results thereof proclaimed within forty-five days after the enactment of this subsection (f).[14]

SEC. 313. (a) The national marketing quota for tobacco established pursuant to the provisions of section 312, less the amount to be allotted under subsection (c) of this section, shall be apportioned by the Secretary among the several States on the basis of the total production of tobacco in each State during the five calendar years immediately preceding the calendar year in which the quota is proclaimed (plus, in applicable years, the normal production on the[15] acreage diverted under previous agricultural adjustment and conservation programs), with such adjustments as are determined to be necessary to make correction for abnormal conditions of production, for small farms, and for trends in production, giving due consideration to seed bed and other plant diseases during such five-year period: *Provided, however,* That to prevent in any case too sharp and sudden reduction in acreage of tobacco production in any State, the marketing quota for flue-cured tobacco for any State for any marketing year shall not be reduced to a point less than 75 per centum of the production of flue-cured tobacco in such State for the year 1937.

(b) The Secretary shall provide, through the local committees, for the allotment of the marketing quota for any State among the farms on which tobacco is produced, on the basis of the following: Past marketing of tobacco, making due allowance for drought, flood, hail, other abnormal weather conditions, plant bed, and other diseases; land, labor, and equipment available for the production of tobacco; crop-rotation practices; and the soil and other physical factors affecting the production of tobacco: *Provided,* That, except for farms on which for the first time in five years tobacco is produced to be marketed in the marketing year for which the quota is effective, the marketing quota for any farm shall not be less than the smaller of either (1) three thousand two hundred pounds, in the case of flue-cured tobacco, and two thousand four hundred pounds, in the case of other kinds of tobacco, or (2) the average tobacco production for the farm during the preceding three years, plus the average normal production of any tobacco acreage diverted under agricultural adjustment and conservation programs during such preceding three years.

(c) The Secretary shall provide through local committees, for the allotment of not in excess of 5 per centum of the national marketing quota (1) to farms in any State whether it has a State quota or not on which for the first time in five years tobacco is produced to be marketed in the year for which the quota is effective and (2) for further increase of allotments to small farms pursuant to the proviso in subsection (b) of this section on the basis of the following: Land, labor, and equipment available for the production of tobacco; crop-rotation practices; and the soil and other physical factors affecting the production of tobacco: *Provided,* That farm marketing quotas established pursuant to this subsection for farms on which tobacco is produced for the first time in five years shall not exceed 75 per centum of the farm marketing quotas established pursuant to subsection (b) of this section for farms which are similar with respect to the following: Land, labor, and equipment available for the production of tobacco, crop-rotation practices, and the soil and other physical factors affecting the production of tobacco.

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[14] This subsection (f) was added by the act entitled "An act amending section 312 of the Agricultural Adjustment Act of 1938," Public, No. 452, 75th Cong., approved March 26, 1938.

[15] The word "net" was deleted by sec. 5 (a) of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938.

(d) Farm marketing quotas may be transferred only in such manner and subject to such conditions as the Secretary may prescribe by regulations.

(e) *In case of flue-cured tobacco, the national quota for 1938 is increased by a number of pounds required to provide for each State in addition to the State poundage allotment a poundage not in excess of* 4 **per centum**[16] *of the allotment which shall be apportioned in amounts which the Secretary determines to be fair and reasonable to farms in the State receiving allotments under the Agricultural Adjustment Act of 1938 which the Secretary determines are inadequate in view of past production of tobacco, and for each year by a number of pounds sufficient to assure that any State receiving a State poundage allotment of flue-cured tobacco shall receive a minimum State poundage allotment of flue-cured tobacco equal to the average national yield for the preceding five years of five hundred acres of such tobacco.*[17]

(f) *In the case of fire-cured and dark air-cured and burley tobacco, the national quota for 1938 is increased by a number of pounds required to provide for each State in addition to the State poundage allotment a poundage not in excess of 2 per centum of the allotment which shall be apportioned in amounts which the Secretary determines to be fair and reasonable to farms in the State receiving allotments under this section which the Secretary determines are inadequate in view of past production of tobacco.*[18]

PENALTIES

SEC. 314. The marketing of any tobacco in excess of the marketing quota for the farm on which the tobacco is produced, except the marketing of any such tobacco for nicotine or other byproduct uses, shall be subject to a penalty of 50 per centum of the market price of such tobacco on the date of such marketing, or, if the following rates are higher, 3 cents per pound in the case of flue-cured, Maryland, or burley, and 2 cents per pound in the case of all other kinds of tobacco. Such penalty shall be paid by the person who acquires such tobacco from the producer but an amount equivalent to the penalty may be deducted by the buyer from the price paid to the producer in case such tobacco is marketed by sale; or, if the tobacco is marketed by the producer through a warehouseman or other agent, such penalty shall be paid by such warehouseman or agent who may deduct an amount equivalent to the penalty from the price paid to the producer: Provided, That in case any tobacco is marketed directly to any person outside the United States the penalty shall be paid and remitted by the producer.

PART II.—MARKETING QUOTAS—CORN

LEGISLATIVE FINDING

SEC. 321. Corn is a basic source of food for the Nation, and corn produced in the commercial corn-producing area moves almost wholly in interstate and foreign commerce in the form of corn, livestock, and livestock products.

Abnormally excessive and abnormally deficient supplies of corn acutely and directly affect, burden, and obstruct interstate and foreign commerce in corn, livestock, and livestock products. When abnormally excessive supplies exist, transportation facilities in interstate and foreign commerce are overtaxed, and the handling and processing facilities through which the flow of interstate and foreign commerce in corn, livestock, and livestock products is directed become acutely congested. Abnormally deficient supplies result in substantial decreases in livestock production and in an inadequate flow of livestock and livestock products in interstate and foreign commerce, with the consequence of unreasonably high prices to consumers.

Violent fluctuations from year to year in the available supply of corn disrupt the balance between the supply of livestock and livestock products moving in interstate and foreign commerce and the supply of corn available for feeding. When available supplies of corn are excessive, corn prices are low and farmers

[16] The bold-faced words were substituted by sec. 2 (a) of the act entitled "An act to amend the Agricultural Adjustment Act of 1938," Public, No. 557, 75th Cong., approved May 31, 1938, in lieu of the expression "2 per centum."

[17] This italicized subsection was added by sec. 5 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938.

[18] This subsection (f) was added by sec. 2 (b) of the act entitled "An act to amend the Agricultural Adjustment Act of 1938," Public, No. 557, 75th Cong., approved May 31, 1938.

overexpand livestock production in order to find outlets for corn. Such expansion, together with the relative scarcity and high price of corn, forces farmers to market abnormally excessive supplies of livestock in interstate commerce at sacrifice prices, endangering the financial stability of producers, and overtaxing handling and processing facilities through which the flow of interstate and foreign commerce in livestock and livestock products is directed. Such excessive marketings deplete livestock on farms, and livestock marketed in interstate and foreign commerce consequently becomes abnormally low, with resultant high prices to consumers and danger to the financial stability of persons engaged in transporting, handling, and processing livestock in interstate and foreign commerce. These high prices in turn result in another overexpansion of livestock production.

Recurring violent fluctuations in the price of corn resulting from corresponding violent fluctuations in the supply of corn directly affect the movement of livestock in interstate commerce from the range cattle regions to the regions where livestock is fattened for market in interstate and foreign commerce, and also directly affect the movement in interstate commerce of corn marketed as corn which is transported from the regions where produced, to the regions where livestock is fattened for market in interstate and foreign commerce.

Substantially all the corn moving in interstate commerce, substantially all the corn fed to livestock transported in interstate commerce for fattening, and substantially all the corn fed to livestock marketed in interstate and foreign commerce, is produced in the commercial corn-producing area. Substantially all the corn produced in the commercial corn-producing area, with the exception of a comparatively small amount used for farm consumption, is either sold or transported in interstate commerce, or is fed to livestock transported in interstate commerce for feeding, or is fed to livestock marketed in interstate and foreign commerce. Almost all the corn produced outside the commercial corn-producing area is either consumed, or is fed to livestock which is consumed, in the State in which such corn is produced.

The conditions affecting the production and marketing of corn and the livestock products of corn are such that, without Federal assistance, farmers, individually or in cooperation, cannot effectively prevent the recurrence of disparities between the supplies of livestock moving in interstate and foreign commerce and the supply of corn available for feeding, and provide for orderly marketing of corn in interstate and foreign commerce and livestock and livestock products in interstate and foreign commerce.

The national public interest requires that the burdens on interstate and foreign commerce above described be removed by the exercise of Federal power. By reason of the administrative and physical impracticability of regulating the movement of livestock and livestock products in interstate and foreign commerce and the inadequacy of any such regulation to remove such burdens, such power can be feasibly exercised only by providing for the withholding from market of excessive and burdensome supplies of corn in times of excessive production, and providing a reserve supply of corn available for market in times of deficient production, in order that a stable and continuous flow of livestock and livestock products in interstate and foreign commerce may at all times be assured and maintained.

FARM MARKETING QUOTAS

SEC. 322. (a) Whenever in any calendar year the Secretary determines from available statistics of the Department, including the August production estimate officially published by the Division of Crop and Livestock Estimates of the Bureau of Agricultural Economics of the Department, that the total supply of corn as of October 1 will exceed the normal supply thereof by more than 10 per centum, marketing quotas shall be in effect in the commercial corn-producing area for the crop of corn grown in such area in such calendar year, and shall remain in effect until terminated in accordance with the provisions of this title.

(b) The Secretary shall determine, on the basis of the estimated average yield of corn in such area for such crop, the acreage in such area which the Secretary determines would make available for the marketing year beginning October 1 a supply of corn (together with the estimated production of corn in the United States outside such area) equal to the normal supply. The percentage which the number of acres so determined is of the total number of

acres of the acreage allotment under section 328 shall be proclaimed by the Secretary. Such percentage is referred to herein as the "marketing percentage."

(c) The Secretary shall proclaim his determinations of facts under subsection (a) and his determination of the marketing percentage under subsection (b) not later than August 15.

(d) Within twenty days after the date of the issuance of the proclamation provided for in subsection (c) of this section, the Secretary shall conduct a referendum, by secret ballot, of farmers who would be subject to such quotas to determine whether such farmers are in favor of or opposed to such quotas. If more than one-third of the farmers voting in the referendum oppose such quotas, the Secretary shall, prior to September 10, proclaim the result of the referendum and such quotas shall not become effective.

(e) Whenever it shall appear from the September production estimates, officially published by the Division of Crop and Livestock Estimates of the Bureau of Agricultural Economics of the Department, that the total supply of corn as of the beginning of the next succeeding marketing year will not exceed the normal supply by more than 10 per centum thereof, the Secretary shall proclaim such fact prior to September 20 if farm marketing quotas have been proclaimed for such marketing year. Thereupon such quotas shall not become effective.

AMOUNT OF FARM MARKETING QUOTA

SEC. 323. (a) The farm marketing quota for any farm with respect to any crop of corn shall be an amount of corn equal to the sum of—

(1) The amount of corn used as silage; and

(2) The actual production of the acreage of corn not used as silage less the amount required for farm consumption and less the storage amount applicable to the farm as ascertained under section 324.

(b) No farm marketing quota with respect to any crop of corn shall be applicable to any farm on which the normal production of the acreage planted to corn is less than three hundred bushels.

STORAGE AMOUNTS

SEC. 324. (a) If the acreage of corn on the farm does not exceed the marketing percentage of the farm acreage allotment, there shall be no storage amount.

(b) If the acreage of corn on the farm exceeds the marketing percentage of the farm acreage allotment, the storage amount shall be a number of bushels equal to the smallest of the following amounts—

(1) The normal production of the acreage of corn on the farm in excess of the marketing percentage of the farm acreage allotment;

(2) The amount by which the actual production of the acreage of corn on the farm exceeds the normal production of the marketing percentage of the farm acreage allotment; or

(3) The amount of the actual production of the acreage of corn on the farm not used for silage.

(c) If the storage amount ascertained under subsection (b) is less than one hundred bushels, there shall be no storage amount.

PENALTIES

SEC. 325. (a) Any farmer who, while any farm marketing quota is in effect for his farm with respect to any crop of corn, markets corn produced on the farm in an amount which is in excess of the aggregate of the farm marketing quotas for the farm in effect at such time, shall be subject to a penalty of 15 cents per bushel of the excess so marketed. Liability for such penalty shall not accrue until the amount of corn stored under seal on such farm or in storage cribs rented by the farmer or under his control is less than the storage amount applicable to such crop plus the storage amounts, if any, applicable to other crops.

(b) If there is stored under seal on the farm or in such cribs an amount of corn equal at least to the storage amount applicable to such crop plus such storage amounts applicable to such other crops, the farmer shall be presumed not to be violating the provisions of subsection (a). When the amount of corn stored under seal on the farm or in such cribs is less than the storage amount applicable to such crop plus such storage amounts applicable to such other crops, the

farmer shall be presumed to have marketed, while farm marketing quotas were in effect, corn in violation of the provisions of subsection (a) to the extent that the amount of corn so stored is less than the aggregate of such storage amounts. In any action brought to enforce the collection of penalties provided for in this section, the farmer, to the extent that the amount of corn so stored is less than the aggregate of such storage amounts shall have the burden of proving that he did not market corn in violation of the provisions of subsection (a).

(c) For the purposes of this Part, corn shall be deemed to be stored by the farmer under seal only if stored in such manner as to conform to the requirements of such regulations as the Secretary shall prescribe in order more effectively to administer this Part.

ADJUSTMENT OF FARM MARKETING QUOTAS

SEC. 326. (a) Whenever in any county or other area the Secretary finds that the actual production of corn plus the amount of corn stored under seal in such county or other area is less than the normal production of the marketing percentage of the farm acreage allotments in such county or other area, the Secretary shall terminate farm marketing quotas for corn in such county or other area.

(b) Whenever, upon any farm, the actual production of the acreage of corn is less than the normal production of the marketing percentage of the farm acreage allotment, there may be marketed, without penalty, from such farm an amount of corn from the corn stored under seal pursuant to section 324 which, together with the actual production of the then current crop, will equal the normal production of the marketing percentage of the farm acreage allotment.

(c) Whenever, in any marketing year, marketing quotas are not in effect with respect to the crop of corn produced in the calendar year in which such marketing year begins, all marketing quotas applicable to previous crops of corn shall be terminated.

PROCLAMATIONS OF SUPPLIES AND COMMERCIAL CORN-PRODUCING AREA

SEC. 327. Not later than September 1, the Secretary shall ascertain and proclaim the total supply, the normal supply, and the reserve supply level for such marketing year. Not later than February 1, the Secretary shall ascertain and proclaim the commercial corn-producing area. The ascertainment and proclamation of the commercial corn-producing area for 1938 shall be made not later than ten days after the date of the enactment of this Act.[19]

ACREAGE ALLOTMENT

SEC. 328. The acreage allotment of corn for any calendar year shall be that acreage in the commercial corn-producing area which, on the basis of the average yield for corn in such area during the ten calendar years immediately preceding such calendar year, *adjusted for abnormal weather conditions and trends in yield*,[20] will produce an amount of corn in such area which the Secretary determines will, together with corn produced in the United States outside the commercial corn-producing area, make available a supply for the marketing year beginning in such calendar year, equal to the reserve supply level. The Secretary shall proclaim such acreage allotment not later than February 1 of the calendar year for which such acreage allotment was determined. The proclamation of the acreage allotment for 1938 shall be made as soon as practicable after the date of the enactment of this Act.[19]

APPORTIONMENT OF ACREAGE ALLOTMENT

SEC. 329. (a) The acreage allotment for corn shall be apportioned by the Secretary among the counties in the commercial corn-producing area on the

[19] Sec. 19 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, provides in part as follows:

"The proclamations heretofore issued by the Secretary of Agriculture under sections 312 (a), 327, 328, and 345 of the Agricultural Adjustment Act of 1938 shall be effective as provided in said sections * * *."

[20] The italicized words were added by sec. 6 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938.

basis of the acreage seeded for the production of corn during the ten calendar years immediately preceding the calendar year in which the apportionment is determined (plus, in applicable years, the acreage diverted under previous agricultural adjustment and conservation programs), with adjustments for abnormal weather conditions and for trends in acreage during such period and for the promotion of soil-conservation practices: *Provided*, That any downward adjustment for the promotion of soil-conservation practices shall not exceed 2 per centum of the total acreage allotment that would otherwise be made to such county.

(b) The acreage allotment to the county for corn shall be apportioned by the Secretary, through the local committees, among the farms within the county on the basis of tillable acreage, crop-rotation practices, type of soil, and topography.

PART III.—MARKETING QUOTAS—WHEAT

LEGISLATIVE FINDINGS

SEC. 331. Wheat is a basic source of food for the Nation, is produced throughout the United States by more than a million farmers, is sold on the country-wide market and, as wheat or flour, flows almost entirely through instrumentalities of interstate and foreign commerce from producers to consumers.

Abnormally excessive and abnormally deficient supplies of wheat on the country-wide market acutely and directly affect, burden, and obstruct interstate and foreign commerce. Abnormally excessive supplies overtax the facilities of interstate and foreign transportation, congest terminal markets and milling centers in the flow of wheat from producers to consumers, depress the price of wheat in interstate and foreign commerce, and otherwise disrupt the orderly marketing of such commodity in such commerce. Abnormally deficient supplies result in an inadequate flow of wheat and its products in interstate and foreign commerce with consequent injurious effects to the instrumentalities of such commerce and with excessive increases in the prices of wheat and its products in interstate and foreign commerce.

It is in the interest of the general welfare that interstate and foreign commerce in wheat and its products be protected from such burdensome surpluses and distressing shortages, and that a supply of wheat be maintained which is adequate to meet domestic consumption and export requirements in years of drought, flood, and other adverse conditions as well as in years of plenty, and that the soil resources of the Nation be not wasted in the production of such burdensome surpluses. Such surpluses result in disastrously low prices of wheat and other grains to wheat producers, destroy the purchasing power of grain producers for industrial products, and reduce the value of the agricultural assets supporting the national credit structure. Such shortages of wheat result in unreasonably high prices of flour and bread to consumers and loss of market outlets by wheat producers.

The conditions affecting the production and marketing of wheat are such that, without Federal assistance, farmers, individually or in cooperation, cannot effectively prevent the recurrence of such surpluses and shortages and the burdens on interstate and foreign commerce resulting therefrom, maintain normal supplies of wheat, or provide for the orderly marketing thereof in interstate and foreign commerce.

The provisions of this Part affording a cooperative plan to wheat producers are necessary in order to minimize recurring surpluses and shortages of wheat in interstate and foreign commerce, to provide for the maintenance of adequate reserve supplies thereof, and to provide for an adequate flow of wheat and its products in interstate and foreign commerce. The provisions hereof for regulation of marketing by producers of wheat whenever an abnormally excessive supply of such commodity exists are necessary in order to maintain an orderly flow of wheat in interstate and foreign commerce under such conditions.

PROCLAMATIONS OF SUPPLIES AND ALLOTMENTS

SEC. 332. Not later than July 15 of each marketing year for wheat, the Secretary shall ascertain and proclaim the total supply and the normal supply of wheat for such marketing year, and the national acreage allotment for the next crop of wheat.

NATIONAL ACREAGE ALLOTMENT

SEC. 333. The national acreage allotment for any crop of wheat shall be that acreage which the Secretary determines will, on the basis of the national average yield for wheat, produce an amount thereof adequate, together with the estimated carry-over at the beginning of the marketing year for such crop, to make available a supply for such marketing year equal to a normal year's domestic consumption and exports plus 30 per centum thereof. The national acreage allotment for wheat for 1938 shall be sixty-two million five hundred thousand acres. *The national acreage allotment for wheat for 1939 shall be not less than fifty-five million acres.*[21]

APPORTIONMENT OF NATIONAL ACREAGE ALLOTMENT

SEC. 334. (a) The national acreage allotment for wheat shall be apportioned by the Secretary among the several States on the basis of the acreage seeded for the production of wheat during the ten calendar years immediately preceding the calendar year in which the national acreage allotment is determined (plus, in applicable years, the acreage diverted under previous agricultural adjustment and conservation programs), with adjustments for abnormal weather conditions and for trends in acreage during such period.

(b) The State acreage allotment for wheat shall be apportioned by the Secretary among the counties in the State, on the basis of the acreage seeded for the production of wheat during the ten calendar years immediately preceding the calendar year in which the national acreage allotment is determined (plus, in applicable years, the ([22]) acreage diverted under previous agricultural adjustment and conservation programs), with adjustments for abnormal weather conditions and trends in acreage during such period and for the promotion of soil-conservation practices.

(c) The allotment to the county shall be apportioned by the Secretary, through the local committees, among the farms within the county on the basis of tillable acres, crop-rotation practices, type of soil, and topography. Not more than 3 per centum of such county allotment shall be apportioned to farms on which wheat has not been planted during any of the three marketing years immediately preceding the marketing year in which the allotment is made.

MARKETING QUOTAS

SEC. 335. (a) Whenever it shall appear that the total supply of wheat as of the beginning of any marketing year will exceed a normal year's domestic consumption and exports by more than 35 per centum, the Secretary shall, not later than the May 15 prior to the beginning of such marketing year, proclaim such fact and, during the marketing year beginning July 1 and continuing throughout such marketing year, a national marketing quota shall be in effect with respect to the marketing of wheat. The Secretary shall ascertain and specify in the proclamation the amount of the national marketing quota in terms of a total quantity of wheat and also in terms of a marketing percentage of the national acreage allotment for the current crop which he determines will, on the basis of the national average yield of wheat, produce the amount of the national marketing quota. Marketing quotas for any marketing year shall be in effect with respect to wheat harvested in the calendar year in which such marketing year begins, notwithstanding that the wheat is marketed prior to the beginning of such marketing year. No marketing quota with respect to the marketing of wheat shall be in effect for the marketing year beginning July 1, 1938, unless prior to the date of the proclamation of the Secretary, provision has been made by law for the payment, in whole or in part, in 1938 of parity payments with respect to wheat.

(b) The amount of the national marketing quota for wheat shall be equal to a normal year's domestic consumption and exports plus 30 per centum thereof, less the sum of (1) the estimated carry-over of wheat as of the beginning of the marketing year with respect to which the quota is proclaimed and (2) the

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[21] The italicized words were added by Public Res. No. 118, 75th Cong., approved June 20, 1938.

[22] The word "net" was deleted by sec. 7 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938.

estimated amount of wheat which will be used on farms as seed or livestock feed during the marketing year.

(c) The farm marketing quota for any farm for any marketing year shall be a number of bushels of wheat equal to the sum of—

(1) A number of bushels equal to the normal production of a number of acres determined by applying the marketing percentage specified in the quota proclamation to the farm acreage allotment for the current crop; and

(2) A number of bushels of wheat equal to the amount, or part thereof, of wheat from any previous crop which the farmer has on hand which, had such amount, or part thereof, been marketed during the preceding marketing year in addition to the wheat actually marketed during such preceding marketing year, could have been marketed without penalty.

In no event shall the farm marketing quota for any farm be less than the normal production of half the farm acreage allotment for the farm.

(d) No farm marketing quota with respect to wheat shall be applicable in any marketing year to any farm on which the normal production of the acreage planted to wheat of the current crop is less than one hundred bushels.

REFERENDUM

SEC. 336. Between the date of the issuance of any proclamation of any national marketing quota for wheat and June 10, the Secretary shall conduct a referendum, by secret ballot, of farmers who will be subject to the quota specified therein to determine whether such farmers favor or oppose such quota. If more than one-third of the farmers voting in the referendum oppose such quota, the Secretary shall, prior to the effective date of such quota, by proclamation suspend the operation of the national marketing quotas with respect to wheat.

ADJUSTMENT AND SUSPENSION OF QUOTAS

SEC. 337. (a) If the total supply as proclaimed by the Secretary within forty-five days after the beginning of the marketing year is less than that specified in the proclamation by the Secretary under section 335 (a), then the national marketing quota specified in the proclamation under such section shall be increased accordingly.

(b) Whenever it shall appear from either the July or the August production estimates, officially published by the Division of Crop and Livestock Estimates of the Bureau of Agricultural Economics of the Department, that total supply of wheat as of the beginning of the marketing year was less than a normal year's domestic consumption and exports plus 30 per centum thereof, the Secretary shall proclaim such fact prior to July 20, or August 20, as the case may be, if farm marketing quotas have been announced with respect to the crop grown in such calendar year. Thereupon such quotas shall become ineffective.

TRANSFER OF QUOTAS

SEC. 338. Farm marketing quotas for wheat shall not be transferable, but, in accordance with regulations prescribed by the Secretary for such purpose, any farm marketing quota in excess of the supply of wheat for such farm for any marketing year may be allocated to other farms on which the acreage allotment has not been exceeded.

PENALTIES

SEC. 339. Any farmer who, while farm marketing quotas are in effect, markets wheat in excess of the farm marketing quota for the farm on which such wheat was produced, shall be subject to a penalty of 15 cents per bushel of the excess so marketed.

PART IV.—MARKETING QUOTAS—COTTON

LEGISLATIVE FINDINGS

SEC. 341. American cotton is a basic source of clothing and industrial products used by every person in the United States and by substantial numbers of people in foreign countries. American cotton is sold on a world-wide market and moves

from the places of production almost entirely in interstate and foreign commerce to processing establishments located throughout the world at places outside the State where the cotton is produced.

Fluctuations in supplies of cotton and the marketing of excessive supplies of cotton in interstate and foreign commerce disrupt the orderly marketing of cotton in such commerce with consequent injury to and destruction of such commerce. Excessive supplies of cotton directly and materially affect the volume of cotton moving in interstate and foreign commerce and cause disparity in prices of cotton and industrial products moving in interstate and foreign commerce with consequent diminution of the volume of such commerce in industrial products.

The conditions affecting the production and marketing of cotton are such that, without Federal assistance, farmers, individually or in cooperation, cannot effectively prevent the recurrence of excessive supplies of cotton and fluctuations in supplies, cannot prevent indiscriminate dumping of excessive supplies on the Nation-wide and foreign markets, cannot maintain normal carry-overs of cotton, and cannot provide for the orderly marketing of cotton in interstate and foreign commerce.

It is in the interest of the general welfare that interstate and foreign commerce in cotton be protected from the burdens caused by the marketing of excessive supplies of cotton in such commerce, that a supply of cotton be maintained which is adequate to meet domestic consumption and export requirements in years of drought, flood, and other adverse conditions as well as in years of plenty, and that the soil resources of the Nation be not wasted in the production of excessive supplies of cotton.

The provisions of this Part affording a cooperative plan to cotton producers are necessary and appropriate to prevent the burdens on interstate and foreign commerce caused by the marketing in such commerce of excessive supplies, and to promote, foster, and maintain an orderly flow of an adequate supply of cotton in such commerce.

FINDING AND PROCLAMATION OF SUPPLIES, AND SO FORTH

SEC. 342. Not later than November 15 of each year the Secretary shall find and proclaim (a) the total supply, the normal supply, and the carry-over of cotton as of August 1 of such year, (b) the probable domestic consumption of American cotton during the marketing year commencing August 1 of such year, (c) the probable exports of American cotton during such marketing year, and (d) the estimated carry-over of cotton as of the next succeeding August 1. For the marketing year 1937–1938 the Secretary shall make all the findings and proclamations provided for in this section not later than ten days after the date of the enactment of this Act.

AMOUNT OF NATIONAL ALLOTMENT

SEC. 343. (a) Not later than November 15 of each year the Secretary shall find and proclaim the amount of the national allotment of cotton for the succeeding calendar year in terms of standard bales of five hundred pounds gross weight. The national allotment shall be the number of bales of cotton adequate, together with the estimated carry-over as of August 1 of such succeeding calendar year, to make available a supply of cotton, for the marketing year beginning on such August 1, equal to the normal supply. The finding and proclamation of the national allotment for the calendar year 1938 shall be made not later than ten days after the date of the enactment of this Act.

(b) If the national allotment for 1938 or 1939 is determined to be less than ten million bales, the national allotment for such year shall be ten million bales for such year, as the case may be. If the national allotment for 1938 or 1939 is determined to be more than eleven million five hundred thousand bales, it shall be eleven million five hundred thousand bales for such year, as the case may be.

(c) Notwithstanding the foregoing provisions of this section, the national allotment *for any year*[23] shall be increased by a number of bales equal to the production of the acres allotted under section 344 (e) for such year.

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[23] The italicized words were substituted, by sec. 8 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, in lieu of the expression "for 1938 and 1939."

APPORTIONMENT OF NATIONAL ALLOTMENT

SEC. 344. (a) The national allotment for cotton for each year (excluding that portion of the national allotment provided for in section 343 (c)) shall be apportioned by the Secretary among the several States on the basis of the average, for the five years preceding the year in which the national allotment is determined, of the normal production of cotton in each State. The normal production of a State for a year shall be (1) the quantity produced therein plus (2) the normal yield of the acres diverted in each county in the State under the previous agricultural adjustment or conservation programs. The normal yield of the acres diverted in any county in any year shall be the average yield per acre of the planted acres in such county in such year times the number of acres diverted in such county in such year.

(b) The Secretary shall ascertain, on the basis of the average yield per acre in each State, a number of acres in such State which will produce a number of bales equal to the allotment made to the State under subsection (a). *Such number of acres plus the number of acres allotted to the State pursuant to subsection (e) (2) is referred to as the "State acreage allotment".*[24] The average yield per acre for any State shall be determined on the basis of the average of the normal production for the State for the years used in computing the allotment to the State, and the average, for the same period, of the acres planted and the acres diverted in the State.

(c) (1) The State acreage allotment (less the amount required for apportionment under paragraph (2)) shall be apportioned annually by the Secretary to the counties in the State. The apportionment to the counties shall be made on the basis of the acreage planted to cotton during the five calendar years immediately preceding the calendar year in which the State allotment is apportioned (plus, in applicable years, the acreage diverted under previous agricultural adjustment and conservation programs), with adjustments for abnormal weather conditions and trends in acreage during such five-year period.

(2) Not more than 2 per centum of the State acreage allotment shall be apportioned to farms in such State which were not used for cotton production during any of the three calendar years immediately preceding the year for which the allotment is made, on the basis of land, labor, and equipment available for the production of cotton; crop rotation practices; and the soil and other physical facilities affecting the production of cotton.

(d) The allotment apportioned to the county under subsection (c) (1), plus any amount allotted to the county under subsection (e), shall be apportioned by the Secretary, through the local committees, among the farms within the county on the following basis:

(1) To each farm on which cotton has been planted during any of the previous three years there shall be allotted the smaller of the following—

(A) Five acres; or

(B) The highest number of acres planted to cotton (plus the acres diverted from the production of cotton under the agricultural adjustment or conservation programs) in any year of such three-year period;

(2) Not more than 3 per centum of the amount remaining, after making the allotments provided for under paragraph (1), shall be allotted, upon such basis as the Secretary deems fair and equitable, to farms (other than farms to which an allotment has been made under paragraph (1) (B)) to which an allotment of not exceeding fifteen acres may be made under other provisions of this subsection; and

(3) The remainder of the total amount available to the county shall be allotted to farms on which cotton has been planted during any of the previous three years (except farms to which an allotment has been made under paragraph (1) (B)). The allotment to each farm under this paragraph, together with the amount of the allotment to such farm under paragraph (1) (A), shall be a prescribed percentage (which percentage shall be the same for all such farms in the county or administrative area) of the acreage, during the preceding year, on the farm which is tilled annually or in regular rotation, excluding from such acreage the acres devoted to the

[24] The italicized words were substituted by sec. 9 (a) of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, in lieu of the following: "Such number of acres is referred to as the 'State acreage allotment.'"

production of *sugarcane for sugar*,[25] wheat, tobacco, or rice for market or *wheat or rice*[25] for feeding to livestock for market: *Provided, however*, That if a farm would be allotted under this paragraph an acreage, together with the amount of the allotment to such farm under paragraph (1) (A), in excess of the largest acreage planted to cotton plus the acreage diverted from the production of cotton under the agricultural adjustment or conservation program during any of the preceding three years, the acreage allotment for such farm shall not exceed such largest acreage so planted and diverted in any such year.

(e) *(1)*[26] For 1938 and 1939, the Secretary shall allot to the several counties, to which an apportionment is made under subsection (c), a number of acres required to provide a total acreage for allotment under this section to such counties of not less than 60 per centum of the sum of (1) the acreage planted to cotton in such counties in 1937, plus (2) the acreage therein diverted from cotton production in 1937 under the agricultural adjustment and conservation program. The acreage so diverted shall be estimated in case data are not available at the time of making such allotment.

(2) The Secretary shall allot to each State to which an allotment is made under subsection (b), and in which at least three thousand five hundred bales were produced in any of the five years immediately preceding the year for which the allotment is made, a number of acres sufficient to provide a total State acreage allotment for such State of not less than five thousand acres.[26]

(f) In apportioning the county allotment among the farms within the county, the Secretary, through the local committees, shall take into consideration different conditions within separate administrative areas within a county if any exist, including types, kinds, and productivity of the soil so as to prevent discrimination among the administrative acres of the county.

(g) For each of the years 1938 and 1939 an acreage equal to 4 per centum of the State acreage allotment shall be apportioned by the Secretary, to counties and farms in the State receiving allotments under this Part, in the following manner:

(1) An amount of the additional allotment provided for in this subsection sufficient to allot to each farm the acreage allotments provided for in subparagraphs (A) (B) of paragraph (1) of subsection (d) of this section shall be used for making such acreage allotments as therein provided.

(2) In counties in which the allotment is not sufficient to provide adequate and representative allotments to other farms in the county as a result of the allotments required by section 344 (d) (1) (A) and (B), an additional acreage shall be allotted to such farms to make the allotment to each of such farms as nearly equal to the allotment which would have been made to such farms in the absence of the provisions of (A) and (B) of subsection 344 (d) (1) as the remainder of the 4 per centum will permit.

(3) After making the allotments provided for in paragraphs (1) and (2) of this subsection the remainder of the 4 per centum may be apportioned in amounts determined by the Secretary to be fair and reasonable to farms or counties receiving allotments which the Secretary determines are inadequate and not representative in view of past production of cotton on the farm or in the county.[27]

(h) Notwithstanding any other provisions of this section, the cotton acreage allotment for any farm for each of the years 1938 and 1939, after making the allotments provided in subsection (g), shall be increased in such amount as may be necessary to provide an allotment of not less than 50 per centum of the sum of the acreage planted in cotton in 1937 and the acreage diverted from cotton production in 1937 under the agricultural conservation program, as determined for each farm in accordance with regulations prescribed by the Secre-

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[25] The italicized words were added by sec. 9 (b) of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938.

[26] The italicized parts of subsection (e) were added by sec. 9 (c) of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938.

[27] This subsection (g) was added by sec. 9 (d) of the act entitled "An Act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938.

tary, and for the crop year 1938 any part of the acreage allotted to individual farms in the State which it is determined, in accordance with regulations prescribed by the Secretary, will not be planted to cotton in the year for which the allotment is made, shall be deducted from the allotments to such farms and may be apportioned, in amounts determined by the Secretary to be fair and reasonable, preference being given to farms in the same county receiving allotments which the Secretary determines are inadequate and not representative in view of the past production of cotton and the acreage diverted from the production of cotton on such farms under the agricultural conservation program in the immediately preceding year: ***Provided,*** That any such transfer of allotment for 1938 shall not affect apportionment for any subsequent years:[28] *Provided, That this subsection shall not operate to raise the cotton acreage of any farm above 40 per centum of the acreage on such farm which is tilled annually or in regular rotation, as determined under regulations prescribed by the Secretary.*[29]

(i) The acreage required for apportionment under subsections (g) and (h) shall be in addition to the State acreage allotment, and the production of such acreage shall be in addition to the national allotment.[29]

MARKETING QUOTAS

SEC. 345. Whenever the Secretary determines that the total supply of cotton for any marketing year exceeds by more than 7 per centum the normal supply thereof for such marketing year, the Secretary shall proclaim such fact not later than November 15 of such marketing year (or, in case of the marketing year 1937–1938, within ten days after the date of enactment of this Act), and marketing quotas shall be in effect during the next succeeding marketing year with respect to the marketing of cotton. Cotton produced in the calendar year in which such marketing year begins shall be subject to the quotas in effect for such marketing year notwithstanding that it may be marketed prior to August 1.[30]

AMOUNT OF FARM MARKETING QUOTAS

SEC. 346. (a) The farm marketing quota for cotton for any farm for any marketing year shall be a number of bales of cotton equal to the sum of—

(1) A number of bales equal to the normal production or the actual production, whichever is the greater, of the farm acreage allotment, and

(2) A number of bales equal to the amount, or part thereof, of cotton from any previous crop which the farmer has on hand, which, had such amount, or part thereof, been marketed during the preceding marketing year in addition to the cotton actually marketed during such preceding marketing year, could have been marketed without penalty.

(b) The penalties provided for in section 348 shall not apply to the marketing of cotton produced on any farm for which a farm acreage allotment has been made for the current crop if the production of the current crop does not exceed one thousand pounds of lint cotton.

REFERENDUM

SEC. 347. Not later than December 15 of any calendar year in which a proclamation of farm marketing quotas pursuant to the provisions of this Part has been made, the Secretary shall conduct a referendum, by secret ballot, of farmers who were engaged in production of the crop harvested prior to the holding of the referendum to determine whether they favor or oppose such quotas. If more

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[28] The bold-face words were added by sec. 1 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938," Public, No. 557, 75th Cong., approved May 31, 1938.

[29] The matter italicized in this subsection (h) and the whole of subsection (i) were added by sec. 9 (d) of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938.

[30] Sec. 19 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, provides as follows:

"The proclamations heretofore issued by the Secretary of Agriculture under sections 312 (a), 327, 328, and 345 of the Agricultural Adjustment Act of 1938 shall be effective as provided in said sections, and no provision of any amendment made by this Act shall be construed as requiring any further action under section 312 (c) or 347 of the Agricultural Adjustment Act of 1938 with respect to marketing years beginning in 1938."

than one-third of the farmers voting in the referendum oppose such quotas, the Secretary shall, prior to the end of such calendar year, proclaim the result of the referendum, and upon such proclamation the quotas shall become ineffective. If a proclamation under section 345 is made with respect to the 1938 crop, the referendum with respect to such crop shall be held not later than thirty days after the date of the enactment of this Act and the result thereof shall be proclaimed not later than forty-five days after such date.[30]

PENALTIES

SEC. 348. Any farmer who, while farm marketing quotas are in effect, markets cotton in excess of the farm marketing quota for the marketing year for the farm on which such cotton was produced, shall be subject to the following penalties with respect to the excess so marketed: 2 cents per pound if marketed during the first marketing year when farm marketing quotas are in effect; and 3 cents per pound if marketed during any subsequent year, except that the penalty shall be 2 cents per pound if cotton of the crop subject to penalty in the first year is marketed subject to penalty in any subsequent year.

INELIGIBILITY FOR PAYMENTS

SEC. 349. (a) Any person who knowingly plants cotton on his farm in any year on acreage in excess of the farm acreage allotment for cotton for the farm for such year under section 344 shall not be eligible for any payment for such year under the Soil Conservation and Domestic Allotment Act, as amended.

(b) *All persons applying for any payment of money under the Soil Conservation and Domestic Allotment Act, as amended, with respect to any farm located in a county in which cotton has been planted during the year for which such payment is offered, shall file with the application a statement that the applicant has not knowingly planted, during the current year, cotton on land on his farm in excess of the acreage allotted to the farm under section 344 for such year.*[31]

LONG STAPLE COTTON

SEC. 350. The provisions of this Part shall not apply to cotton the staple of which is 1⅛ inches or more in length.

PART V.—MARKETING QUOTAS—RICE

LEGISLATIVE FINDING

SEC. 351. (a) The marketing of rice constitutes one of the great basic industries of the United States, with ramifying activities which directly affect interstate and foreign commerce at every point, and stable conditions therein are necessary to the general welfare. Rice produced for market is sold on a Nation-wide market, and, with its products, moves almost wholly in interstate and foreign commerce from the producer to the ultimate consumer. The farmers producing such commodity are subject in their operations to uncontrollable natural causes; in many cases such farmers carry on their farming operations on borrowed money or leased lands and are not so situated as to be able to organize effectively, as can labor and industry, through unions and corporations enjoying Government sanction and protection for joint economic action. For these reasons, among others, the farmers are unable without Federal assistance to control effectively the orderly marketing of such commodity, with the result that abnormally excessive supplies thereof are produced and dumped indiscriminately on the Nation-wide market.

(b) The disorderly marketing of such abnormally excessive supplies affects, burdens, and obstructs interstate and foreign commerce by (1) materially affect-

[30] See footnote on preceding page.

[31] This subsection (b) was substituted by sec. 10 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, in lieu of the following subsection:

"(b) All persons applying for any payment of money under the Soil Conservation and Domestic Allotment Act, as amended, shall file with the application a statement verified by affidavit that the applicant has not knowingly planted, during the current year, cotton on land on his farm in excess of the acreage allotted to the farm under section 344 for such year. Any person who knowingly swears falsely in any statement required under this subsection shall be guilty of perjury."

ing the volume of such commodity marketed therein, (2) disrupting the orderly marketing of such commodity therein, (3) reducing the prices for such commodity, with consequent injury and destruction of such commerce in such commodity, and (4) causing a disparity between the prices for such commodity in interstate and foreign commerce and industrial products therein, with a consequent diminution of the volume of interstate and foreign commerce in industrial products.

(c) Whenever an abnormally excessive supply of rice exists, the marketing of such commodity by the producers thereof directly and substantially affects interstate and foreign commerce in such commodity and its products, and the operation of the provisions of this Part becomes necessary and appropriate in order to promote, foster, and maintain an orderly flow of such supply in interstate and foreign commerce.

NATIONAL ACREAGE ALLOTMENT

SEC. 352. The national acreage allotment of rice for any calendar year shall be that acreage which the Secretary determines will, on the basis of the national average yield of rice for the five calendar years immediately preceding the calendar year for which such national average yield is determined, produce an amount of rice adequate, together with the estimated carry-over from the marketing year ending in such calendar year, to make available a supply for the marketing year commencing in such calendar year not less than the normal supply. Such national acreage allotment shall be proclaimed not later than December 31 of each year.

APPORTIONMENT OF NATIONAL ACREAGE ALLOTMENT

SEC. 353. (a) The national acreage allotment of rice for each calendar year shall be apportioned by the Secretary among the several States in which rice is produced in proportion to the average number of acres of rice in each State during the five-year period immediately preceding the calendar year for which such national acreage allotment of rice is determined (plus, in applicable years, the acreage diverted under previous agricultural adjustment and conservation programs) with adjustments for trends in acreage during the applicable period.

(b) Not less than 97 per centum of the acreage allotted to any State shall be apportioned annually by the Secretary through local and State committees of farmers among the persons producing rice within such State on the basis of past production of rice; land, labor, and available equipment for the production of rice; crop-rotation practices, soil fertility, and other physical factors affecting the production of rice: *Provided*, That not exceeding 3 per centum of the acreage allotted to each State shall be apportioned annually by the Secretary through local and State committees of farmers among persons who for the first time in the past five years are producing rice on the basis of the applicable standards of apportionment set forth in this subsection: *Provided further*, That a person producing rice for the first time in five years shall not be allotted an acreage in excess of 75 per centum of the allotment that would be made to him if he were not producing rice for the first time in such five years.

DOMESTIC ALLOTMENT OF RICE

SEC. 354. (a) Not later than December 31 of each year the Secretary shall ascertain from the latest available statistics of the Department and shall proclaim the total amount of rice which will be needed during the next succeeding marketing year to meet the requirements of consumers in the United States. Such amount is hereinafter referred to as the "domestic allotment of rice."

(b) The domestic allotment of rice for each marketing year shall be apportioned by the Secretary among the several States in which rice is produced in proportion to the average amount of rice produced in each State during the five-year period including the calendar year in which such domestic allotment is announced (plus, in applicable years, the normal production of any acreage diverted under previous agricultural adjustment and conservation programs), with adjustments for abnormal weather conditions and trends in acreage during the applicable period.

(c) The Secretary shall provide, through local and State committees of farmers, for the allotment of each State apportionment among persons producing rice in such State. The apportionment of the domestic allotment of rice among persons producing rice in each State shall be on the basis of the aggregate normal yields of the acreage allotments established with respect to such persons.

MARKETING QUOTAS

SEC. 355. (a) If at the time of any proclamation made under the provisions of section 354 (a) it shall appear from the latest available statistics of the Department that the total supply of rice exceeds the normal supply thereof for the current marketing year by more than 10 per centum of such normal supply, the Secretary shall also proclaim that, beginning on the first day of the marketing year next following and continuing throughout such year a national marketing quota shall be in effect for marketings of rice by producers: *Provided*, That no marketing quota shall be in effect for the marketing year commencing August 1, 1938. The Secretary shall also ascertain and specify in such proclamation the amount of the national marketing quota in terms of the total quantity thereof which may be marketed by producers which shall be that amount of rice which the Secretary determines will make available during such marketing year a normal supply.

(b) Within thirty days after the date of the issuance of the proclamation specified in subsection (a) of this section, the Secretary shall conduct a referendum, by secret ballot, of producers who would be subject to the national marketing quota for rice to determine whether such producers are in favor of or opposed to such quota. If more than one-third of the producers voting in the referendum oppose such quota, the Secretary shall, prior to the 15th day of February, proclaim the result of the referendum, and such quota shall not become effective.

(c) The national marketing quota shall be apportioned among States and persons producing rice in each State, including new producers, in the manner and upon the basis set forth in section 354 for the apportionment of the domestic allotment of rice.

(d) Marketing quotas may be transferred only in such manner and subject to such conditions as the Secretary may prescribe by regulations.

PENALTIES

SEC. 356. Any producer who markets rice in excess of his marketing quota shall be subject to a penalty of one-quarter of 1 cent per pound of the excess so marketed.

SUBTITLE C—ADMINISTRATIVE PROVISIONS

PART I.—PUBLICATION AND REVIEW OF QUOTAS

APPLICATION OF PART

SEC. 361. This Part shall apply to the publication and review of farm marketing quotas established for tobacco, corn, wheat, cotton, and rice, established under subtitle B.

PUBLICATION AND NOTICE OF QUOTA

SEC. 362. All acreage allotments, and the farm marketing quotas established for farms in a county or other local administrative area shall, in accordance with regulations of the Secretary, be made and kept freely available for public inspection in such county or other local administrative area. An additional copy of this information shall be kept available in the office of the county agricultural extension agent or with the chairman of the local committee. Notice of the farm marketing quota of his farm shall be mailed to the farmer.

REVIEW BY REVIEW COMMITTEE

SEC. 363. Any farmer who is dissatisfied with his farm marketing quota may, within fifteen days after mailing to him of notice as provided in section 362, have such quota reviewed by a local review committee composed of three farmers appointed by the Secretary. Such committee shall not include any member of the local committee which determined the farm acreage allotment, the normal yield, or the farm marketing quota for such farm. Unless application for review is made within such period, the original determination of the farm marketing quota shall be final.

REVIEW COMMITTEE

SEC. 364. The members of the review committee shall receive as compensation for their services the same per diem as that received by the members of

the committee utilized for the purposes of the Soil Conservation and Domestic Allotment Act, as amended. The members of the review committee shall not be entitled to receive compensation for more than thirty days in any one year.

INSTITUTION OF PROCEEDINGS

SEC. 365. If the farmer is dissatisfied with the determination of the review committee, he may, within fifteen days after a notice of such determination is mailed to him by registered mail, file a bill in equity against the review committee as defendant in the United States district court, or institute proceedings for review in any court of record of the State having general jurisdiction, sitting in the county or the district in which his farm is located, for the purpose of obtaining a review of such determination. Bond shall be given in an amount and with surety satisfactory to the court to secure the United States for the costs of the proceeding. The bill of complaint in such proceeding may be served by delivering a copy thereof to any one of the members of the review committee. Thereupon the review committee shall certify and file in the court a transcript of the record upon which the determination complained of was made, together with its findings of fact.

COURT REVIEW

SEC. 366. The review by the court shall be limited to questions of law, and the findings of fact by the review committee, if supported by evidence, shall be conclusive. If application is made to the court for leave to adduce additional evidence, and it is shown to the satisfaction of the court that such additional evidence is material and that there were reasonable grounds for failure to adduce such evidence in the hearing before the review committee, the court may direct such additional evidence to be taken before the review committee in such manner and upon such terms and conditions as to the court may seem proper. The review committee may modify its findings of fact or its determination by reason of the additional evidence so taken, and it shall file with the court such modified findings or determination, which findings of fact shall be conclusive. At the earliest convenient time, the court, in term time or vacation, shall hear and determine the case upon the original record of the hearing before the review committee, and upon such record as supplemented, if supplemented, by further hearing before the review committee pursuant to direction of the court. The court shall affirm the review committee's determination, or modified determination, if the court determines that the same is in accordance with law. If the court determines that such determination or modified determination is not in accordance with law, the court shall remand the proceeding to the review committee with direction either to make such determination as the court shall determine to be in accordance with law or to take such further proceedings as, in the court's opinion, the law requires.

STAY OF PROCEEDINGS AND EXCLUSIVE JURISDICTION

SEC. 367. The commencement of judicial proceedings under this Part shall not, unless specifically ordered by the court, operate as a stay of the review committee's determination. Notwithstanding any other provision of law, the jurisdiction conferred by this Part to review the legal validity of a determination made by a review committee pursuant to this Part shall be exclusive. No court of the United States or of any State shall have jurisdiction to pass upon the legal validity of any such determination except in a proceeding under this Part.

NO EFFECT ON OTHER QUOTAS

SEC. 368. Notwithstanding any increase of any farm marketing quota for any farm as a result of review of the determination thereof under this Part, the marketing quotas for other farms shall not be affected.

PART II.—ADJUSTMENT OF QUOTAS AND ENFORCEMENT

GENERAL ADJUSTMENTS OF QUOTAS

SEC. 371. (a) If at any time the Secretary has reason to believe that in the case of corn, wheat, cotton, rice, or tobacco the operation of farm marketing

quotas in effect will cause the amount of such commodity which is free of marketing restrictions to be less than the normal supply for the marketing year for the commodity then current, he shall cause an immediate investigation to be made with respect thereto. In the course of such investigation due notice and opportunity for hearing shall be given to interested persons. If upon the basis of such investigation the Secretary finds the existence of such fact, he shall proclaim the same forthwith. He shall also in such proclamation specify such increase in, or termination of, existing quotas as he finds, on the basis of such investigation, is necessary to make the amount of such commodity which is free of marketing restrictions equal the normal supply.

(b) If the Secretary has reason to believe that, because of a national emergency or because of a material increase in export demand, any national marketing quota for corn, wheat, cotton, rice, or tobacco should be increased or terminated, he shall cause an immediate investigation to be made to determine whether the increase or termination is necessary in order to effectuate the declared policy of this Act or to meet such emergency or increase in export demand. If, on the basis of such investigation, the Secretary finds that such increase or termination is necessary, he shall immediately proclaim such finding (and if he finds an increase is necessary, the amount of the increase found by him to be necessary) and thereupon such quota shall be increased, or shall terminate, as the case may be.

(c) In case any national marketing quota for any commodity is increased under this section, each farm marketing quota for the commodity shall be increased in the same ratio.

(d) In the case of corn, whenever such proclamation specifies an increase in marketing quotas, the storage amounts applicable to corn shall be adjusted downward to the amount which would have been required to be stored if such increased marketing quotas had been in effect. Whenever in the case of corn, such proclamation provides for termination of marketing quotas, storage under seal shall no longer be required.

PAYMENT AND COLLECTION OF PENALTIES

SEC. 372. (a) The penalty with respect to the marketing, by sale, of wheat, cotton, or rice, if the sale is to any person within the United States, shall be collected by the buyer.

(b) All penalties provided for in Subtitle B shall be collected and paid in such manner, at such times, and under such conditions as the Secretary may by regulations prescribe. Such penalties shall be remitted to the Secretary by the person liable for the penalty, except that if any other person is liable for the collection of the penalty, such other person shall remit the penalty. The amount of such penalties shall be covered into the general fund of the Treasury of the United States.

(c) Whenever, pursuant to a claim filed with the Secretary within one year after payment to him of any penalty collected from any person pursuant to this Act, the Secretary finds that such penalty was erroneously, illegally, or wrongfully collected, the Secretary shall certify to the Secretary of the Treasury for payment to the claimant, in accordance with regulations prescribed by the Secretary of the Treasury, such amount as the Secretary finds the claimant is entitled to receive as a refund of such penalty.[32]

The Secretary is authorized to prescribe regulations governing the filing of such claims and the determination of such refunds.

(d) No penalty shall be collected under this Act with respect to the marketing of any agricultural commodity grown for experimental purposes only by any publicly owned agricultural experiment station.[32]

REPORTS AND RECORDS

SEC. 373. (a) This subsection shall apply to warehousemen, processors, and common carriers of corn, wheat, cotton, rice, or tobacco, and all ginners of cotton, all persons engaged in the business of purchasing corn, wheat, cotton, rice, or tobacco from producers, and all persons engaged in the business of redrying, prizing, or stemming tobacco for producers. Any such person shall, from time

[32] The italicized subsection was added by sec. 11 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938.

to time on request of the Secretary, report to the Secretary such information and keep such records as the Secretary finds to be necessary to enable him to carry out the provisions of this title. Such information shall be reported and such records shall be kept in accordance with forms which the Secretary shall prescribe. For the purpose of ascertaining the correctness of any report made or record kept, or of obtaining information required to be furnished in any report, but not so furnished, the Secretary is hereby authorized to examine such books, papers, records, accounts, correspondence, contracts, documents, and memoranda as he has reason to believe are relevant and are within the control of such person. Any such person failing to make any report or keep any record as required by this subsection or making any false report or record shall be deemed guilty of a misdemeanor and upon conviction thereof shall be subject to a fine of not more than $500.

(b) Farmers engaged in the production of corn, wheat, cotton, rice, or tobacco for market shall furnish such proof of their acreage, yield, storage, and marketing of the commodity in the form of records, marketing cars, reports, storage under seal, or otherwise as the Secretary may prescribe as necessary for the administration of this title.

(c) All data reported to or acquired by the Secretary pursuant to this section shall be kept confidential by all officers and employees of the Department, and only such data so reported or acquired as the Secretary deems relevant shall be disclosed by them, and then only in a suit or administrative hearing under this title.

MEASUREMENT OF FARMS AND REPORT OF PLANTINGS

SEC. 374. The Secretary shall provide, through the county and local committees, for measuring farms on which corn, wheat, cotton, or rice is produced, and for ascertaining whether the acreage planted for any year to any such commodity is in excess of the farm acreage allotment for such commodity for the farm under this title. If in the case of any farm the acreage planted to any such commodity on the farm is in excess of the farm acreage allotment for such commodity for the farm, the committee shall file with the State committee a written report stating the total acreage on the farm in cultivation and the acreage planted to such commodity.

REGULATION

SEC. 375. (a) The Secretary shall provide by regulations for the identification, wherever necessary, of corn, wheat, cotton, rice, or tobacco so as to afford aid in discovering and identifying such amounts of the commodities as are subject to and such amounts thereof as are not subject to marketing restrictions in effect under this title.

(b) The Secretary shall prescribe such regulations as are necessary for the enforcement of this title.

COURT JURISDICTION

SEC. 376. The several district courts of the United States are hereby vested with jurisdiction specifically to enforce the provisions of this title. If and when the Secretary shall so request, it shall be the duty of the several district attorneys in their respective districts, under the direction of the Attorney General, to institute proceedings to collect the penalties provided in this title. The remedies and penalties provided for herein shall be in addition to, and not exclusive of, any of the remedies or penalties under existing law.

SUBTITLE D—MISCELLANEOUS PROVISIONS AND APPROPRIATIONS

PART I—MISCELLANEOUS

COTTON PRICE ADJUSTMENT PAYMENTS

SEC. 381. (a) For the purposes of the provisions (relating to cotton price adjustment payments with respect to the 1937 cotton crop) of the Third Deficiency Appropriation Act, fiscal year 1937, a producer shall be deemed to have complied with the provisions of the 1938 agricultural adjustment program formulated under the legislation contemplated by Senate Joint Resolution Numbered 207, Seventy-fifth Congress, if his acreage planted to cotton in 1938 does not exceed his farm acreage allotment for 1938 under the Soil Conservation and Domestic

Allotment Act, as amended (including the amendments made by this Act), or under section 344 of this Act, whichever is the lesser. For the purposes of this subsection a producer shall not be deemed to have exceeded his farm acreage allotment unless such producer knowingly exceeded his farm acreage allotment. Such compliance shall not be required in any case where the producer is not engaged in cotton production in 1938. *In cases where in 1937 a total or partial crop failure resulted from hail, drought, flood, or boll-weevil infestation, or where any part of a producer's 1937 cotton crop was destroyed after the harvesting thereof by fire or other unavoidable natural cause, if the producer is otherwise eligible for payment, payment shall be made at the same rate per pound on the same percentage of the producer's normal base production established by the Secretary as in the case of other producers.*[33] For the purpose of such provisions of the Third Deficiency Appropriation Act, fiscal year 1937, cotton not sold prior to July 1, 1938, shall be held and considered to have been sold on June 30, 1938, and all applications for price adjustment payments shall be filed with the Secretary not later than July 15, 1938. Such payments shall be made at the earliest practicable time. Application for payment may be mde by the 1937 operator of a farm on behalf of all persons engaged in cotton production on the farm in 1937 and need be signed only by such operator, but payment shall be made directly to each of the persons entitled thereto. In case any person who is entitled to payment hereunder dies, becomes incompetent, or disappears before receiving such payment or is succeeded by another who renders or completes the required performance, payment shall, without regard to any other provisions of law, be made as the Secretary may determine to be fair and reasonable in all the circumstances and provide by regulations.

(b) Any producer for whom a loan has been made or arranged for by the Commodity Credit Corporation on cotton of his 1937 crop and who has complied with all the provisions of the loan agreement except section 8 thereof, may, at any time before July 1, 1938, transfer his right, title, and interest in and to such cotton to the Corporation; and the Corporation is authorized and directed to accept such right, title, and interest in and to such cotton and to assume all obligations of the producer with respect to the loan on such cotton, including accrued interest and accrued carrying charges to the date of such transfer. The Corporation shall notify the Secretary of Agriculture of each such transfer, and upon receipt of such notice, the Secretary shall as soon as compliance is shown, or a national marketing quota for cotton is put into effect, forthwith pay to such producer a sum equal to 2 cents per pound of such cotton, and the amount so paid shall be deducted from any price adjustment payment to which such producer is entitled.

(c) The Commodity Credit Corporation is authorized on behalf of the United States to sell any cotton of the 1937 crop so acquired by it, but no such cotton or any other cotton held on behalf of the United States shall be sold unless the proceeds of such sale are at least sufficient to reimburse the United States for all amounts (including any price-adjustment payment) paid out by any of its agencies with respect to the cotton so sold. After July 31, 1939, the Commodity Credit Corporation shall not sell more than three hundred thousand bales of cotton in any calendar month, or more than one million five hundred thousand bales in any calendar year. The proceeds derived from the sale of any such cotton shall be used for the purpose of discharging the obligations assumed by the Commodity Credit Corporation with respect to such cotton, and any amounts not expended for such purpose shall be covered into the Treasury as miscellaneous receipts.

EXTENSION OF 1937 COTTON LOAN

SEC. 382. The Commodity Credit Corporation is hereby authorized and directed to provide for the extension, from July 31, 1938, to July 31, 1939, of the maturity date of all notes evidencing a loan made or arranged for by the Corporation on cotton produced during the crop year 1937–1938. This section shall not be construed to prevent the sale of any such cotton on request of the person liable on the note.

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[33] The italicized words were substituted by sec. 12 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, in lieu of the following: "In cases where in 1937 a total or partial crop failure resulted from hail, drought, flood, or boll-weevil infestation, if the producer is otherwise eligible for payment, payment shall be made at the rate of 3 cents per pound on the same percentage of the producer's normal base production established by the Secretary as in the case of other producers."

For supplemental legislation see next to last proviso to the item entitled "Conservation and Use of Agricultural Land Resources, Department of Agriculture," Department of Agriculture Appropriation Act, 1939, *infra*, page 68.

INSURANCE OF COTTON AND RECONCENTRATION OF COTTON

SEC. 383. (a) The Commodity Credit Corporation shall place all insurance of every nature taken out by it on cotton, and all renewals, extensions, or continuations of existing insurance, with insurance agents who are bona fide residents of and doing business in the State where the cotton is warehoused: *Provided*, That such insurance may be secured at a cost not greater than similar insurance offered on said cotton elsewhere.

(b) Cotton held as security for any loan heretofore or hereafter made or arranged for by the Commodity Credit Corporation shall not hereafter be reconcentrated without the written consent of the producer or borrower.[34]

REPORT OF BENEFITS

SEC. 384. The Secretary shall submit to Congress an annual report of the names of persons to whom, during the preceding years, payments were made under the Soil Conservation and Domestic Allotment Act, as amended, together with payments under section 303 of this Act, if any, if the total amount paid to such person exceeded $1,000.

FINALITY OF FARMERS' PAYMENTS AND LOANS

SEC. 385. The facts constituting the basis for any Soil Conservation Act payment, parity payment, or loan, or the amount thereof, when officially determined in conformity with the applicable regulations prescribed by the Secretary or by the Commodity Credit Corporation, shall be final and conclusive and shall not be reviewable by any other officer or agency of the Government.

SEC. 386. The provisions of section 3741 of the Revised Statutes (U. S. C., 1934 edition, title 41, sec. 22) and sections 114 and 115 of the Criminal Code of the United States (U. S. C., 1934 edition, title 18, secs. 204 and 205) shall not be applicable to loans or payments made under this Act (except under section 383 (a)).

PHOTOGRAPHIC REPRODUCTIONS AND MAPS

SEC. 387. The Secretary may furnish reproductions of such aerial or other photographs, mosaics, and maps as have been obtained in connection with the authorized work of the Department to farmers and governmental agencies at the estimated cost of furnishing such reproductions, and to persons other than farmers at such prices (not less than estimated cost of furnishing such reproductions) as the Secretary may determine, the money received from such sales to be deposited in the Treasury to the credit of the appropriation charged with the cost of making such reproductions. This section shall not affect the power of the Secretary to make other disposition of such or similar materials under any other provisions of existing law.

UTILIZATION OF LOCAL AGENCIES

SEC. 388. (a) The provisions of section 8 (b) and section 11 of the Soil Conservation and Domestic Allotment Act, as amended, relating to the utilization of State, county, local committees, the extension service, and other approved agencies, and to recognition and encouragement of cooperative associations, shall apply in the administration of this Act; and the Secretary shall, for such purposes, utilize the same local, county, and State committees as are utilized under sections 7 to 17, inclusive, of the Soil Conservation and Domestic Allotment Act, as amended. The local administrative areas designated under section 8 (b) of the Soil Conservation and Domestic Allotment Act, as amended, for the administration of programs under that Act, and the local administrative areas designated for the administration of this Act shall be the same.

(b) The Secretary is authorized and directed, from any funds made available for the purposes of the Acts in connection with which county committees are utilized, to make payments to county committees of farmers to cover the estimated administrative expenses incurred or to be incurred by them in cooperating in carrying out the provisions of such Acts. All or part of such estimated administrative expenses of any such committee may be deducted pro rata from

[34] For supplemental legislation, see *infra*, page 353.

the Soil Conservation Act payments, parity payments, or loans, or other payments under such Acts, made unless payment of such expenses is otherwise provided by law. The Secretary may make such payments to such committees in advance of determination of performance by farmers.

PERSONNEL

SEC. 389. The Secretary is authorized and directed to provide for the execution by the Agricultural Adjustment Administration of such of the powers conferred upon him by this Act as he deems may be appropriately exercised by such Administration; and for such purposes the provisions of law applicable to appointment and compensation of persons employed by the Agricultural Adjustment Administration shall apply.

SEPARABILITY

SEC. 390. If any provision of this Act, or the application thereof to any person or circumstance, is held invalid, the validity of the remainder of the Act and the application of such provision to other persons or circumstances, and the provisions of the Soil Conservation and Domestic Allotment Act, as amended, shall not be affected thereby. Without limiting the generality of the foregoing, if any provision of this Act should be held not to be within the power of the Congress to regulate interstate and foreign commerce, such provision shall not be held invalid if it is within the power of the Congress to provide for the general welfare or any other power of the Congress. If any provision of this Act for marketing quotas with respect to any commodity should be held invalid, no provision of this Act for marketing quotas with respect to any other commodity shall be affected thereby. If the application of any provision for a referendum should be held invalid, the application of other provisions shall not be affected thereby. If by reason of any provision for a referendum the application of any such other provision to any person or circumstance is held invalid, the application of such other provision to other persons or circumstances shall not be affected thereby.

PART II.—APPROPRIATIONS AND ADMINISTRATIVE EXPENSES

APPROPRIATIONS

SEC. 391. (a) Beginning with the fiscal year ending June 30, 1938, there is hereby authorized to be appropriated, for each fiscal year for the administration of this Act and for the making of soil conservation and other payments such sums as Congress may determine, in addition to any amount made available pursuant to section 15 of the Soil Conservation and Domestic Allotment Act, as amended.

(b) For the administration of this Act (including the provisions of title V) during the fiscal year ending June 30, 1938, there is hereby authorized to be made available from the funds appropriated for such fiscal year for carrying out the purposes of sections 7 to 17 of the Soil Conservation and Domestic Allotment Act, as amended, a sum not to exceed $5,000,000.

ADMINISTRATIVE EXPENSES

SEC. 392. (a) The Secretary is authorized and directed to make such expenditures as he deems necessary to carry out the provisions of this Act, including personal services and rents in the District of Columbia and elsewhere, traveling expenses (including the purchase, maintenance, and repair of passenger-carrying vehicles), supplies and equipment, law books, books of reference, directories, periodicals, and newspapers.

(b) In the administration of this title, sections 7 to 17, inclusive, of the Soil Conservation and Domestic Allotment Act, as amended, and section 32, as amended, of the Act entitled "An Act to amend the Agricultural Adjustment Act, and for other purposes," approved August 24, 1935, the aggregate amount expended in any fiscal year, beginning with the fiscal year ending June 30, 1939, for administrative expenses in the District of Columbia, including regional offices, shall not exceed 1 per centum of the total amount available for such fiscal year for carrying out such Acts, and the aggregate amount expended in any fiscal year for administrative expenses in the several States (not including

the expenses of county and local committees) shall not exceed 2 per centum of the total amount available for such fiscal year for carrying out such Acts. In the event any administrative expenses of any county or local committee are deducted in any fiscal year, beginning with the fiscal year ending June 30, 1939, from Soil Conservation Act payments, parity payments, or loans, each farmer receiving benefits under such provisions shall be apprised, in the form of a statement to accompany the check evidencing such benefit payment or loan, of the amount or percentage deducted from such benefit payment or loan on account of such administrative expenses. The names and addresses of the members and employees of any county or local committee, and the amount of such compensation received by each of them, shall be posted annually in a conspicuous place in the area within which they are employed.

ALLOTMENT OF APPROPRIATIONS

SEC. 393. All funds for carrying out the provisions of this Act shall be available for allotment to bureaus and offices of the Department, and for transfer to such other agencies of the Federal Government, and to such State agencies, as the Secretary may request to cooperate or assist in carrying out the provisions of this Act.

TITLE IV—COTTON POOL PARTICIPATION TRUST CERTIFICATES

SEC. 401. There is hereby authorized to be appropriated, from any moneys in the Treasury of the United States not otherwise appropriated, the sum of $1,800,000, or so much thereof as may be required by the Secretary to accomplish the purposes hereinafter declared and authorized. The Secretary of the Treasury is hereby authorized and directed to pay to, or upon the order of, the Secretary, such a part or all of the sum hereby authorized to be appropriated at the request of the Secretary.

SEC. 402. The Secretary is hereby authorized to draw from the Treasury of the United States any part or all of the sum hereby authorized to be appropriated, and to deposit same to his credit with the Treasurer of the United States, under special symbol number, to be available for disbursement for the purposes hereinafter stated.

SEC. 403. The Secretary is hereby authorized to make available, from the sum hereby authorized to be appropriated, to the manager of the cotton pool, such sum or sums as may be necessary to enable the manager to purchase, take up, and cancel, subject to the restrictions hereinafter reserved, pool participation trust certificates, form C–5–I, where such certificates shall be tendered to the manager, cotton pool, by the person or persons shown by the records of the Department to have been the lawful holder and owner thereof on *or before May 1, 1938*,[35] the purchase price to be paid for the certificates so purchased to be at the rate of $1 per five-hundred-pound bale for every bale or fractional part thereof represented by the certificates C–5–I. The Secretary is further authorized to pay directly, or to advance to, the manager of the cotton pool, to enable him to pay costs and expenses incident to the purchase of certificates as aforesaid, and any balance remaining to the credit of the Secretary, or the manager, cotton pool, not required for the purchase of these certificates in accordance with provisions of this Act, shall, at the expiration of the purchase period, be covered into the Treasury of the United States as miscellaneous receipts.

SEC. 404. The authority of the manager, cotton pool, to purchase and pay for certificates hereunder shall extend to and include the 31st day of July 1938: *Provided*, That after expiration of the said limit, the purchase may be consummated of any certificates tendered to the manager, cotton pool, on or before July 31, 1938, but where for any reason the purchase price shall not have been paid by the manager, cotton pool. The Secretary is authorized to promulgate such rules, regulations, and requirements as in his discretion are proper to effectuate the general purposes of this title, which purpose is here stated to be specifically to authorize the purchase of outstanding pool participation trust certificates, form C–5–I, for a purchase price to be determined at the rate of $1 per bale, or twenty one-hundredths cent per pound, for the cotton evidenced

[35] The italicized matter was substituted by sec. 13 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, in lieu of "May 1, 1937."

by the said certificates, provided such certificates be tendered by holders thereof in accordance with regulations prescribed by the Secretary not later than the 31st day of July 1938, and provided such certificates may not be purchased from persons other than those shown by the records of the Department to have been holders thereof on or before the 1st day of *May 1938.*[36]

SEC. 405. The Secretary is authorized to continue in existence the 1933 cotton producers pool so long as may be required to effectuate the purposes of this title. All expense incident to the accomplishment of purposes of this title may be paid from funds hereby authorized to be appropriated, for which purpose the fund hereby authorized to be appropriated shall be deemed as supplemental to such funds as are now to the credit of the Secretary, reserved for the purpose of defraying operating expenses of the pool.

SEC. 406. After expiration of the time limit herein established, the certificates then remaining outstanding and not theretofore tendered to the manager, cotton pool, for purchase, shall not be purchased and no obligation on account thereof shall exist.

SEC. 407. Nothing in this title shall be construed to authorize the manager, cotton pool, to pay the assignee or any holder of such cotton pool participation trust certificates, form C–5–I, transferred *subsequent to*[37] May 1, 1937, as shown by the records of the Department of Agriculture, more than the purchase price paid by the assignee or holder of such certificate or certificates with interest at the rate of 4 per centum per annum from the date of purchase, provided the amount paid such assignee shall not exceed $1 per bale. Before making payment to any assignee, whose certificates were transferred *subsequent to*[36] May 1, 1937, such assignee shall file with the manager, cotton pool, an affidavit showing the amount paid by him for such certificate and the date of such payment, and the manager, cotton pool, is authorized to make payment to such assignee based upon the facts stated in said affidavit as aforesaid.

TITLE V—CROP INSURANCE

SHORT TITLE AND APPLICATION OF OTHER PROVISIONS

SEC. 501. This title may be cited as the "Federal Crop Insurance Act." Except as otherwise expressly provided the provisions in titles I to IV, inclusive, shall not apply with respect to this title, and the term "Act" wherever it appears in such titles shall not be construed to include this title.

DECLARATION OF PURPOSE

SEC. 502. It is the purpose of this title to promote the national welfare by alleviating the economic distress caused by wheat-crop failures due to drought and other causes, by maintaining the purchasing power of farmers, and by providing for stable supplies of wheat for domestic consumption and the orderly flow thereof in interstate commerce.

SEC. 503. To carry out the purposes of this title, there is hereby created as an agency of and within the Department of Agriculture a body corporate with the name "Federal Crop Insurance Corporation" (herein called the Corporation). The principal office of the Corporation shall be located in the District of Columbia, but there may be established agencies or branch offices elsewhere in the United States under rules and regulations prescribed by the Board of Directors.

CAPITAL STOCK

SEC. 504. (a) The Corporation shall have a capital stock of $100,000,000 subscribed by the United States of America, payment for which shall, with the approval of the Secretary of Agriculture, be subject to call in whole or in part by the Board of Directors of the Corporation.

Any impairment of the capital stock described in this subsection shall be restored only out of operating profits of the Corporation.

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[36] The italicized matter was substituted by sec. 14 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, in lieu of "May 1937."

[37] The italicized matter was substituted by sec. 15 of the act entitled "An act to amend the Agricultural Adjustment Act of 1938, and for other purposes," Public, No. 470, 75th Cong., approved April 7, 1938, in lieu of "on or before."

(b) There is hereby authorized to be appropriated not more than $100,000,000 for the purpose of subscribing to said stock. No part of such sum shall be available prior to July 1, 1938. The appropriation for such purpose for the fiscal year ending June 30, 1939, shall not exceed $20,000,000 and shall be made only out of the unexpended balances for the fiscal year ending June 30, 1938, of the sums appropriated pursuant to section 15 of the Soil Conservation and Domestic Allotment Act, as amended.

(c) Receipts for payments by the United States of America for or on account of such stock shall be issued by the Corporation to the Secretary of the Treasury and shall be evidence of the stock ownership by the United States of America.

MANAGEMENT OF CORPORATION

SEC. 505. (a) The management of the Corporation shall be vested in a Board of Directors (hereinafter called the "Board") subject to the general supervision of the Secretary of Agriculture. The Board shall consist of three persons employed in the Department of Agriculture who shall be appointed by and hold office at the pleasure of the Secretary of Agriculture.

(b) Vacancies in the Board so long as there shall be two members in office shall not impair the powers of the Board to execute the functions of the Corporation, and two of the members in office shall constitute a quorum for the transaction of the business of the Board.

(c) The Directors of the Corporation appointed as hereinbefore provided shall receive no additional compensation for their services as such directors but may be allowed actual necessary traveling and subsistence expenses when engaged in business of the Corporation outside of the District of Columbia.

(d) The Board shall select, subject to the approval of the Secretary of Agriculture, a manager, who shall be the executive officer of the Corporation with such power and authority as may be conferred upon him by the Board.

GENERAL POWERS

SEC. 506. The Corporation—

(a) shall have succession in its corporate name;

(b) may adopt, alter, and use a corporate seal, which shall be judicially noticed;

(c) may make contracts and purchase or lease and hold such real and personal property as it deems necessary or convenient in the transaction of its business, and may dispose of such property held by it upon such terms as it deems appropriate;

(d) subject to the provisions of section 508 (c), may sue and be sued in its corporate name in any court of competent jurisdiction, State or Federal: *Provided*, That no attachment, injunction, garnishment, or other similar process, mesne or final, shall be issued against the Corporation or its property;

(e) may adopt, amend, and repeal bylaws, rules, and regulations governing the manner in which its business may be conducted and the powers granted to it by law may be exercised and enjoyed;

(f) shall be entitled to the free use of the United States mails in the same manner as the other executive agencies of the Government;

(g) with the consent of any board, commission, independent establishment, or executive department of the Government, including any field service thereof, may avail itself of the use of information, services, facilities, officials, and employees thereof in carrying out the provisions of this title;

(h) may conduct researches, surveys, and investigations relating to crop insurance for wheat and other agricultural commodities;

(i) shall determine the character and necessity for its expenditures under this title and the manner in which they shall be incurred, allowed, and paid, without regard to the provisions of any other laws governing the expenditure of public funds and such determinations shall be final and conclusive upon all other officers of the Government; and

(j) shall have such powers as may be necessary or appropriate for the exercise of the powers herein specifically conferred upon the Corporation and all such incidental powers as are customary in corporations generally.

PERSONNEL

SEC. 507. (a) The Secretary shall appoint such officers and employees as may be necessary for the transaction of the business of the Corporation, which

appointments may be made without regard to the civil-service laws and regulations, fix their compensation in accordance with the provisions of the Classification Act of 1923, as amended, define their authority and duties, delegate to them such of the powers vested in the Corporation as he may determine, require bond of such of them as he may designate, and fix the penalties and pay the premiums of such bonds. The appointment of officials and the selection of employees by the Secretary shall be made only on the basis of merit and efficiency.

(b) Insofar as applicable, the benefits of the Act entitled "An Act to provide compensation for employees of the United States suffering injuries while in the performance of their duties, and for other purposes," approved September 7, 1916, as amended, shall extend to persons given employment under the provisions of this title, including the employees of the committees and associations referred to in subsection (c) of this section and the members of such committees.

(c) The Board may establish or utilize committees or associations of producers in the administration of this title and make payments to such committees or associations to cover the estimated administrative expenses to be incurred by them in cooperating in carrying out this title and may provide that all or part of such estimated expenses may be included in the insurance premiums provided for in this title.

(d) The Secretary of Agriculture may allot to bureaus and offices of the Department of Agriculture or transfer to such other agencies of the State and Federal Governments as he may request to assist in carrying out this title any funds made available pursuant to the provisions of section 516 of this Act.

(e) In carrying out the provisions of this title the Board may, in its discretion, utilize producer-owned and producer-controlled cooperative associations: *Provided further, That the Corporation may, upon such terms and conditions as it shall determine, accept payments from producers in any year to be applied toward premiums on their insurance contracts for the current and next succeeding year.*[38]

CROP INSURANCE

SEC. 508. To carry out the purposes of this title the Corporation is authorized and empowered—

(a) Commencing with the wheat crop planted for harvest in 1939, to insure, upon such terms and conditions not inconsistent with the provisions of this title as it may determine, producers of wheat against loss in yields of wheat due to unavoidable causes, including drought, flood, hail, wind, winterkill, lightning, tornado, insect infestation, plant disease, and such other unavoidable causes as may be determined by the Board: *Provided, however,* That for the first three years of operation under this title contracts of insurance shall not be made for periods longer than one year. Such insurance shall not cover losses due to the neglect or malfeasance of the producer or to the failure of the producer to reseed in areas and under circumstances where it is customary to reseed. Such insurance shall cover not less than 50 or more than 75 per centum, to be determined by the Board, of the recorded or appraised average yield of wheat on the insured farm for a representative base period subject to such adjustments as the Board may prescribe to the end that the average yields fixed for farms in the same area, which are subject to the same conditions, may be fair and just. The Board may condition the issuance of such insurance in any county or area upon a minimum amount of participation in a program of crop insurance formulated pursuant to this title.

(b) To fix adequate premiums for such insurance, payable either in wheat or cash equivalent as of the due date thereof, on the basis of the recorded or appraised average crop loss of wheat on the insured farm for a representative base period subject to such adjustments as the Board may prescribe to the end that the premiums fixed for farms in the same area, which are subject to the same conditions, may be fair and just. Such premiums shall be collected at such time or times, in such manner, and upon such security as the Board may determine.

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[38] The italicized matter was added by the act entitled "An act to amend the Federal Crop Insurance Act," Public, No. 691, 75th Cong., approved June 22, 1938.

(c) To adjust and pay claims for losses either in wheat or in cash equivalent under rules prescribed by the Board. In the event that any claim for indemnity under the provisions of this title is denied by the Corporation an action on such claim may be brought against the Corporation in the district court of the United States in and for the district in which the insured farm is located, and exclusive jurisdiction is hereby conferred upon such courts to determine such controversies without regard to the amount in controversy: *Provided*, That no suit on such claim shall be allowed under this section unless the same shall have been brought within one year after the date when notice of denial of the claim is mailed to the claimant.

(d) From time to time, in such manner and through such agencies as the Board may determine, to purchase, handle, store, insure, provide storage facilities for, and sell wheat, and pay any expenses incidental thereto, it being the intent of this provision, however, that, insofar as practicable, the Corporation shall purchase wheat only at the rate and to a total amount equal to the payment of premiums in cash by farmers or to replace promptly wheat sold to prevent deterioration; and shall sell wheat only to the extent necessary to cover payments of indemnities and to prevent deterioration: *Provided, however*, That nothing in this section shall prevent prompt offset purchases and sales of wheat for convenience in handling. The restriction on the purchase and sale of wheat provided in this section shall be made a part of any crop insurance agreement made under this title. Notwithstanding any provision of this title, there shall be no limitation upon the legal or equitable remedies available to the insured to enforce against the Corporation the foregoing restriction with respect to purchases and sales of wheat.

INDEMNITIES EXEMPT FROM LEVY

SEC. 509. Claims for indemnities under this title shall not be liable to attachment, levy, garnishment, or any other legal process before payment to the insured or to deduction on account of the indebtedness of the insured or his estate to the United States except claims of the United States or the Corporation arising under this title.

DEPOSIT OF FUNDS

SEC. 510. All money of the Corporation not otherwise employed may be deposited with the Treasurer of the United States or in any bank approved by the Secretary of the Treasury, subject to withdrawal by the Corporation at any time, or with the approval of the Secretary of the Treasury may be invested in obligations of the United States or in obligations guaranteed as to principal and interest by the United States. Subject to the approval of the Secretary of the Treasury, the Federal Reserve banks are hereby authorized and directed to act as depositories, custodians, and fiscal agents for the Corporation in the performance of its powers conferred by this title.

TAX EXEMPTION

SEC. 511. The Corporation, including its franchise, its capital, reserves, and surplus, and its income and property, shall be exempt from all taxation now or hereafter imposed by the United States or by any Territory, dependency, or possession thereof, or by any State, county, municipality, or local taxing authority.

FISCAL AGENT OF GOVERNMENT

SEC. 512. When designated for that purpose by the Secretary of the Treasury, the Corporation shall be a depository of public money, except receipts from customs, under such regulations as may be prescribed by said Secretary; and it may also be employed as a financial agent of the Government; and it shall perform all such reasonable duties, as a depository of public money and financial agent of the Government, as may be required of it.

ACCOUNTING BY CORPORATION

SEC. 513. The Corporation shall at all times maintain complete and accurate books of account and shall file annually with the Secretary of Agriculture a complete report as to the business of the Corporation. The financial transactions

of the Corporation shall be audited at least once each year by the General Accounting Office for the sole purpose of making a report to Congress, together with such recommendations as the Comptroller General of the United States may deem advisable: *Provided*, That such report shall not be made until the Corporation shall have had reasonable opportunity to examine the exceptions and criticisms of the Comptroller General or the General Accounting Office, to point out errors therein, explain or answer the same, and to file a statement which shall be submitted by the Comptroller General with his report.

CRIMES AND OFFENSES

SEC. 514. (a) Whoever makes any statement knowing it to be false, or whoever willfully overvalues any security, for the purpose of influencing in any way the action of the Corporation, or for the purpose of obtaining for himself or another money, property, or anything of value, under this title, shall be punished by a fine of not more than $5,000 or by imprisonment for not more than two years, or both.

(b) No person shall, while acting in any official capacity in the administration of this title, speculate, directly or indirectly, in any agricultural commodity or product thereof, to which this title applies, or in contracts relating thereto, or in the stock or membership interests of any association or corporation engaged in handling, processing, or disposing of any such commodity or product. Any person violating this subsection shall upon conviction thereof be fined not more than $10,000 or imprisoned not more than two years, or both.

(c) Whoever, being connected in any capacity with the Corporation, (1) embezzles, abstracts, purloins, or willfully misapplies any moneys, funds, securities, or other things of value, whether belonging to the Corporation or pledged or otherwise entrusted to it; or (2) with intent to defraud the Corporation, or any other body politic or corporate, or any individual, or to deceive any officer, auditor, or examiner of the Corporation, makes any false entry in any book, report, or statement of, or to, the Corporation or draws any order, or issues, puts forth, or assigns any note or other obligation or draft, mortgage, judgment, or decree thereof; or (3) with intent to defraud the Corporation, participates or shares in or receives directly or indirectly any money, profit, property, or benefits through any transaction, loan, commission, contract, or any other acts of the Corporation, shall be punished by a fine of not more than $10,000 or by imprisonment for not more than five years, or both.

(d) Whoever willfully shall conceal, remove, dispose of, or convert to his own use or to that of another, any property mortgaged or pledged to, or held by, the Corporation, as security for any obligation, shall be punished by a fine of not more than $5,000 or by imprisonment for not more than two years, or both.

(e) Whoever conspires with another to accomplish any of the acts made unlawful by the preceding provisions of this section shall, on conviction thereof, be subject to the same fine or imprisonment, or both, as is applicable in the case of conviction for doing such unlawful act.

(f) The provisions of sections 112, 113, 114, 115, 116, and 117 of the Criminal Code of the United States (U. S. C., title 18, secs. 202 to 207, inclusive) insofar as applicable are extended to apply to contracts or agreements with the Corporation under this title: *Provided, however*, That the provisions of section 3741 of the Revised Statutes (U. S. C., title 41, sec. 22) and sections 114 and 115 of the Criminal Code of the United States shall not apply to any crop-insurance agreements made under this title.

ADVISORY COMMITTEE

SEC. 515. The Secretary of Agriculture is authorized to appoint from time to time an advisory committee, consisting of not more than five members experienced in agricultural pursuits and appointed with due consideration to their geographical distribution, to advise the Corporation with respect to carrying out the purposes of this title. The compensation of the members of such committee shall be determined by the Board but shall not exceed $10 per day each while actually employed and actual necessary traveling and subsistence expenses, or a per diem allowance in lieu thereof.

APPROPRIATIONS AND REGULATIONS

SEC. 516. (a) There are hereby authorized to be appropriated such sums, not in excess of $6,000,000 for each fiscal year beginning after June 30, 1938, as may be necessary to cover the operating and administrative costs of the Corporation, which shall be allotted to the Corporation in such amounts and at such time or times as the Secretary of Agriculture may determine: *Provided*, That expenses in connection with the purchase, transportation, handling, or sale of wheat may be considered by the Corporation as being nonadministrative or nonoperating expenses. For the fiscal year ending June 30, 1939, the appropriation authorized under this subsection is authorized to be made only out of the unexpended balances for the fiscal year ending June 30, 1938, of the sums appropriated pursuant to section 15 of the Soil Conservation and Domestic Allotment Act, as amended.

(b) The Secretary and the Corporation, respectively, are authorized to issue such regulations as may be necessary to carry out the provisions of this title.

SEPARABILITY

SEC. 517. The sections of this title and subdivisions of sections are hereby declared to be separable, and in the event any one or more sections or parts of the same of this title be held to be unconstitutional, the same shall not affect the validity of other sections or parts of sections of this title.

RIGHT TO AMEND

SEC. 518. The right to alter, amend, or repeal this title is hereby reserved.

Approved, February 16, 1938, 3 p. m.

PART III.—ANNOTATED COMPILATION OF LEGISLATION MAKING AVAILABLE FUNDS FOR CARRYING OUT THE PURPOSES OF SECTIONS 7–17, INCLUSIVE, OF THE SOIL CONSERVATION AND DOMESTIC ALLOTMENT ACT, AS AMENDED, AND THE AGRICULTURAL ADJUSTMENT ACT OF 1938, AS AMENDED, AND OF RELATED LEGISLATION

APPROPRIATIONS TO CARRY OUT SECTIONS 7 TO 17, SOIL CONSERVATION AND DOMESTIC ALLOTMENT ACT, AS AMENDED, ET CETERA

FISCAL YEAR 1937 [1]

To enable the Secretary of Agriculture to carry into effect the provisions of sections 7 to 17, inclusive, of the Soil Conservation and Domestic Allotment Act, approved February 29, 1936 (Public, No. 461, 74th Congress), including the employment of personal services and rent in the District of Columbia and elsewhere, printing and binding, purchase of law books, books of reference, periodicals and newspapers, and other necessary expenses, $440,000,000, together with not to exceed $30,000,000 of the funds made available under the head "Payments for Agricultural Adjustment" in the Supplemental Appropriation Act, fiscal year 1936, approved February 11, 1936 (Public, No. 440, 74th Congress); to be immediately available and to remain available until June 30, 1938, for compliances under said Act in the calendar year 1936: *Provided*, That no part of such amount shall be available after June 30, 1937, for salaries and other administrative expenses except for payment of obligations therefor incurred prior to July 1, 1937: *Provided further*, That the Secretary of Agriculture may, in his discretion, from time to time transfer to the General Accounting Office such sums as may be necessary to pay administrative expenses of the General Accounting Office in auditing payments under this item.[2]

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[1] Sec. 2 of the Independent Offices Appropriation Act, 1937, approved March 19, 1936, 49 Stat. 1167.

[2] Sec. 7 (c) of Title IV of the First Deficiency Appropriation Act, fiscal year 1936, provided as follows: "The appropriation made by section 2 of the Independent Offices Appropriation Act, 1937, for carrying out sections 7 to 17, inclusive, of the Soil Conservation and Domestic Allotment Act is hereby made available to the Department of Agriculture for the purposes of carrying out such Act with respect to land devoted to growing trees for the production of gum turpentine and gum rosin."

The item entitled "Conservation and Use of Agricultural Land Resources, Department of Agriculture" contained in the Department of Agriculture Appropriation Act, 1938, provides in part as follows: "That not to exceed $5,000,000 of the funds appropriated under

FISCAL YEAR 1938 [3]

To enable the Secretary of Agriculture to carry into effect the provisions of sections 7 to 17, inclusive, of the Soil Conservation and Domestic Allotment Act, approved February 29, 1936 (U. S. C., Supp. II, title 16, secs. 590g–590q), including the employment of personal services and rent in the District of Columbia and elsewhere; printing and binding; purchase of law books, books of reference, periodicals, and newspapers; and other necessary expenses, $340,000,000, together with not to exceed $110,000,000 of the funds made available for the fiscal years 1937 and 1938 by section 32 of the Act entitled "An Act to amend the Agricultural Adjustment Act, and for other purposes," approved August 24, 1935 (U. S. C., Supp. II, title 7, sec. 612c): *Provided*, That the unobligated funds made available for the fiscal year 1937 be first transferred, and not to exceed $50,000,000 of the unexpended balance of the appropriation of $100,000,000 provided under section 12 (a), title I, of the Agricultural Adjustment Act of May 12, 1933 (U. S. C., Supp. II, title 7, sec. 612), in all, not to exceed $500,000,000, to remain available until June 30, 1939, for compliances under said Act of February 29, 1936, pursuant to the provisions of the 1937 programs carried out during the period November 1, 1936, to December 31, 1937, inclusive: *Provided*, That no part of such amount shall be available after June 30, 1938, for salaries and other administrative expenses except for payment of obligations therefor incurred prior to July 1, 1938: *Provided further*, That such amount shall be available for salaries and other administrative expenses in connection with the formulation and administration of the 1938 programs or plans now or hereafter authorized under section 7 or 8, or both, of said Act: *Provided further*, That the Secretary of Agriculture may, in his discretion, from time to time transfer to the General Accounting Office such sums as may be necessary to pay administrative expenses of the General Accounting Office in auditing payments under this item: *Provided further*, That such amount shall be available for the purchase of seeds, fertilizers, or any other farming materials and making grants thereof to agricultural producers to aid them in carrying out farming practices approved by the Secretary of Agriculture in the 1937 programs, for the reimbursement of the Tennessee Valley Authority for fertilizers heretofore or hereafter furnished by it to the Secretary of Agriculture for such purpose, and for the payment of all expenses necessary in making such grants including all or part of the costs incident to the delivery thereof: *Provided further*, That not to exceed $5,000,000 of the funds appropriated under section 2 of the "Independent Offices Appropriation Act, 1937" is hereby made available subject to the limitations prescribed therein, for compliances in the calendar year 1937 under the provisions of sections 7 to 17, inclusive, of the Soil Conservation and Domestic Allotment Act, approved February 29, 1936, but obligations incurred hereunder with respect to such compliances shall not be included in applying the limitations on the amount of obligations which may be incurred for any calendar year contained in section 16 of said Soil Conservation and Domestic Allotment Act: *And provided further*, That the funds provided by section 32 of the Act entitled "An Act to amend the Agricultural Adjustment Act, and for other purposes," approved August 24, 1935 (U. S. C., Supp. II, title 7, sec. 612c), shall be available during the fiscal year 1938 for administrative expenses in such sums as the President may direct in carrying out the provisions of said section, including the employment of persons and means in the District of Columbia and elsewhere, in accordance with the provisions of law applicable to the employment of persons and means by Agricultural Adjustment Administration.

FISCAL YEAR 1939 [4]

To enable the Secretary of Agriculture to carry into effect the provision of sections 7 to 17, inclusive, of the Soil Conservation and Domestic Allotment Act,

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section 2 of the 'Independent Offices Appropriation Act, 1937' is hereby made available, subject to the limitations prescribed therein, for compliance in the calendar year 1937 under the provisions of sections 7 to 17, inclusive, of the Soil Conservation and Domestic Allotment Act, approved February 29, 1936, but obligations incurred hereunder with respect to such compliances shall not be included in applying the limitations on the amount of obligations which may be incurred for any calendar year contained in section 16 of said Soil Conservation and Domestic Allotment Act."

[3] Item entitled "Conservation and Use of Agricultural Land Resources, Department of Agriculture," contained in the Department of Agriculture Appropriation Act, 1938, approved June 29, 1937, 50 Stat. 395.

[4] Item entitled "Conservation and Use of Agricultural Land Resources, Department of Agriculture," contained in the Department of Agriculture Appropriation Act, 1939, approved June 16, 1938.

approved February 29, 1936 (16 U. S. C. 590g–590q), and the provisions of the Agricultural Adjustment Act of 1938 (except the making of payments pursuant to sections 303 and 381 and the provisions of titles IV and V), including the employment of persons and means in the District of Columbia and elsewhere; rent in the District of Columbia; printing and binding; purchase of law books, books of reference, periodicals, and newspapers, $345,000,000, together with not to exceed $155,000,000 of the unexpended balance of the appropriations made by the Supplemental Appropriation Act, fiscal year 1936, under the head "Payments for Agricultural Adjustment" (49 Stat. 1116), by section 12 (a), title I, of the Agricultural Adjustment Act of May 12, 1933 (7 U. S. C. 612), and by section 2 of the Independent Offices Appropriation Act, 1937, approved March 19, 1936 (49 Stat. 1183), in all, not to exceed $500,000,000, to remain available until June 30, 1940, for compliances under said Act of February 29, 1936, as amended, pursuant to the provisions of the 1938 programs carried out during the period November 1, 1937, to December 31, 1938, inclusive: *Provided*, That no part of such amount shall be available for carrying out the provisions of section 202 (f) of the Agricultural Adjustment Act of 1938, and not to exceed $100,000 shall be available under the provisions of section 202 (a) to 202 (e), inclusive, of said Act to conduct a survey to determine the location of said laboratories and the scope of the investigations to be made and to coordinate the research work now being carried on: *Provided further*, That no part of such amount shall be available after June 30, 1939, for salaries and other administrative expenses except for payment of obligations therefor incurred prior to July 1, 1939: *Provided further*, That such amount shall be available for salaries and other administrative expenses in connection with the formulation and administration of the 1939 programs or plans now or hereafter authorized under section 7 or 8, or both, of said Act of February 29, 1936, or under said provisions of the Agricultural Adjustment Act of 1938: *Provided further*, That the Secretary of Agriculture may, in his discretion, from time to time transfer to the General Accounting Office such sums as may be necessary to pay administrative expenses of the General Accounting Office in auditing payments under this item: *Provided further*, That such amount shall be available for the purchase of seeds, fertilizers, lime, trees, or any other farming materials and making grants thereof to agricultural producers to aid them in carrying out farming practices approved by the Secretary of Agriculture in the 1938 and 1939 programs under said Act of February 29, 1936, as amended; for the reimbursement of the Tennessee Valley Authority or any other Government agency for fertilizers, seeds, lime, trees, or other farming materials furnished by such agency; and for the payment of all expenses necessary in making such grants, including all or part of the costs incident to the delivery thereof: *And provided further*, That the funds provided by section 32 of the Act entitled "An Act to amend the Agricultural Adjustment Act, and for other purposes", approved August 24, 1935 (7 U. S. C. 612c), shall be available during the fiscal year 1939 for administrative expenses, in accordance with the provisions of section 392 of the Agricultural Adjustment Act of 1938, in carrying out the provisions of said section, including the employment of persons and means in the District of Columbia and elsewhere, in accordance with the provisions of law applicable to the employment of persons and means by Agricultural Adjustment Administration: *And provided further*, That in carrying out the provisions of the Third Deficiency Appropriation Act, fiscal year 1937, and section 381 (a) of the Agricultural Adjustment Act of 1938, as amended, relating to cotton price adjustment payments with respect to the 1937 cotton crop, in order to accelerate such payments the Secretary shall, notwithstanding said provisions, (1) treat all cotton not sold prior to September 10, 1937, as if it had been sold on a date when the average price of seven-eighths-inch Middling cotton on the ten designated spot cotton markets was less than 9 cents per pound; (2) make payment on the basis of applications filed prior or subsequent to July 16, 1938, on forms prescribed by the Secretary, by the 1937 operator or other person designated pursuant to regulations prescribed by the Secretary on behalf of all the producers on the farm in 1937 or by individual producers, provided that (a) payment will not be made to the 1938 operator of the farm unless he certifies that he has complied thereon with the requirements defined in said section 381 (a), which certificate shall be taken to certify to such compliance on the part of all producers on the farm in 1938 who produced cotton in 1937, (b) payment shall not be delivered to any operator or producer until he has agreed in writing to refund the payment forthwith upon demand in case it is subsequently found that he has failed to comply with the requirements as defined herein and in said section 381 (a), (c) in cases where cotton was produced in 1937 on two or more

producer units on the farm it shall be assumed that the production thereon was uniform, and (d) it shall be assumed that there was a total or partial crop failure resulting from hail, drought, flood, or boll-weevil infestation (which is defined to include any other insect or fungus) only if the yield in 1937 is below the base yield for the farm and in such case the total production shall be considered to be the normal yield for the farm multiplied by the number of acres planted to cotton in 1937; and (3) make payments, as soon as practicable, on the basis of his estimate of the amounts which will be covered by the applications to be filed and of the funds to be used out of the appropriation for the necessary administrative expenses of making the cotton price adjustment payments: *And provided further*, That in administering the naval stores conservation programs authorized in section 8 of the Soil Conservation and Domestic Allotment Act and in making payments thereunder to gum naval stores producers the Secretary may utilize the services of regional associations of such producers or any agency of the Government in lieu of the State, county, and other local committees utilized in the other agricultural conservation programs if he finds that more efficient administration will result, and the provisions of section 388 (b) of the Agricultural Adjustment Act of 1938 shall otherwise be applicable to the administration of said naval stores conservation programs.

APPROPRIATION TO CARRY OUT THE AGRICULTURAL ADJUSTMENT ACT OF 1938[5]

For the administration of the Agricultural Adjustment Act of 1938 (including the provisions of title 5 thereof) during the fiscal year ending June 30, 1938, there is hereby appropriated out of the unexpended balance of the funds appropriated for such fiscal year for carrying out the purposes of the Soil Conservation and Domestic Allotment Act, as amended, not to exceed the sum of $5,000,000, as authorized by subsection (b) of section 391 of such Agricultural Adjustment Act of 1938.

APPROPRIATION TO CARRY OUT THE FEDERAL CROP INSURANCE ACT[6]

Administrative and operating expenses: Not to exceed $5,500,000 of the unobligated balance of the appropriation made in the Department of Agriculture Appropriation Act, 1938, under the heading "Conservation and Use of Agricultural Land Resources, Department of Agriculture," is hereby made available for operating and administrative expenses under the Federal Crop Insurance Act (title V, Agricultural Adjustment Act of 1938), approved February 16, 1938, during the fiscal year ending June 30, 1939, to be allotted by the Secretary of Agriculture (a) to the Federal Crop Insurance Corporation, as authorized by section 516 (a) of such Act, and (b) to bureaus and offices of the Department of Agriculture or for transfer to other agencies of State and Federal Governments, as authorized by section 507 (d) of such Act; and such part as the Secretary allots under clause (b) hereof, shall be available for the employment of persons and means in the District of Columbia and elsewhere, rent in the District of Columbia, printing and binding, purchase of law books, books of reference, periodicals, and newspapers.

Subscriptions to capital stock, Federal Crop Insurance Corporation: Not to exceed $20,000,000 of the unobligated balance of the appropriation made in the Department of Agriculture Appropriation Act, 1938, approved June 29, 1937, under the head "Conservation and Use of Agricultural Land Resources, Department of Agriculture," is hereby made available for use by the Secretary of the Treasury during the fiscal year 1939, at such times and in such amounts as the Secretary of Agriculture may request, for the purpose of subscribing to and paying for the capital stock of the Federal Crop Insurance Corporation of the United States of America, as provided for in section 504 of the Federal Crop Insurance Act, approved February 16, 1938. The payment for said stock by the Secretary of the Treasury shall, with the approval of the Secretary of Agriculture, be subject to call in whole or in part by the Board of Directors of the Federal Crop Insurance Corporation, and shall be effected by transfer of funds on the books of the Treasury Department to the credit of the corporation, the funds so transferred to be subject to requisition by the corporation with the approval of the Secretary of Agriculture.

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[5] Sec. 2 of Public Res. No. 81, 75th Cong., approved March 2, 1938.

[6] The item entitled "Federal Crop Insurance Act" contained in the Department of Agriculture Appropriation Act, 1939, approved June 16, 1938.

APPROPRIATION FOR RETIREMENT OF COTTON POOL PARTICIPATION TRUST CERTIFICATES[7]

To enable the Secretary of Agriculture to carry into effect the provisions of title IV of the Agricultural Adjustment Act of 1938, approved February 16, 1938, fiscal year 1938, to remain available until June 30, 1939, $1,800,000: *Provided*, That the Secretary of Agriculture may, in his discretion, from time to time transfer to the General Accounting Office such sums as may be necessary to pay administrative expenses of the General Accounting Office in auditing payments under this title: *Provided further*, That the authority of the manager, cotton pool, to purchase and pay for participation trust certificates, Form C–5–I, shall extend to and include the 31st day of December 1938 but after the expiration of said limit, the purchase may be consummated of any such certificates tendered to the manager, cotton pool, on or before December 31, 1938, but where for any reason the purchase price shall not have been paid by the manager, cotton pool: *Provided further*, That the date May 1, 1938, appearing in title IV of the Agricultural Adjustment Act of 1938, as amended, shall not be applicable: *Provided further*, That in case any person who is entitled to payment on a participation trust certificate, Form C–5–I, dies, becomes incompetent, or disappears before receiving such payment or before application for such payment is executed, the Secretary of Agriculture shall provide by regulations, without regard to any other provisions of law, for such payment to such person as he may determine to be fairly and reasonably entitled thereto.

INTERNATIONAL PRODUCTION CONTROL COMMITTEES[8]

During the fiscal year 1939 the Secretary of Agriculture may expend not to exceed $17,500 from the funds available to the Agricultural Adjustment Administration for the share of the United States as a member of the International Wheat Advisory Committee, the International Sugar Council, or like events or bodies concerned with the reduction of agricultural surpluses or with other objectives of the Agricultural Adjustment Administration, together with traveling and other necessary expenses relating thereto.

INTERNATIONAL PRODUCTION CONTROL COMMITTEES[9]

The limitation in the amount which the Secretary of Agriculture may expend for the objects specified under this head in the Agricultural Appropriation Act for the fiscal year 1938, from the funds available to the Agricultural Adjustment Administration, is hereby increased from $7,500 to $10,000.

PRICE ADJUSTMENT ACT OF 1938[10]

SEC. 501. There is hereby appropriated out of any money in the Treasury not otherwise appropriated, to be available until expended, the sum of $212,000,000 to enable the Secretary of Agriculture to make parity payments to producers of wheat, cotton, corn (in the commercial corn-producing area), rice, and tobacco pursuant to the provisions of section 303 of the Agricultural Adjustment Act of 1938: *Provided, however*, That, notwithstanding the provisions of said section, one-half of this sum shall be apportioned among such commodities in accordance with the provisions of said section 303 of the Agricultural Adjustment Act of 1938 and one-half shall be apportioned among such commodities in the same proportion that funds available for sections 7 to 17, inclusive, of the Soil Conservation and Domestic Allotment Act would be allocated to such commodities in connection with the 1939 agricultural conservation program on the basis of the standards set forth in section 104 of the Agricultural Adjustment Act of 1938: *Provided further*, That such payments with respect to any such commodity shall be made upon the normal yield of the farm acreage allotment established for the commodity under the 1939 agricultural conservation program, and shall be made with respect to a farm only in the event that the acreage planted to the commodity for harvest on the farm in 1939 is not in excess of the farm

[7] The item entitled "Retirement of Cotton Pool Participation Trust Certificates" contained in the Department of Agriculture Appropriation Act, 1939, approved June 16, 1938.
[8] Excerpt from the Department of Agriculture Appropriation Act, 1939, approved June 16, 1938.
[9] Excerpt from the Third Deficiency Appropriation Act, fiscal year 1937, Public, No. 354, 75th Cong., approved August 25, 1937.
[10] The "Price Adjustment Act of 1938" is Title V of Public Res. No. 122, 75th Cong., approved June 21, 1938.

acreage allotment established for the commodity under said program: *And provided further*, That the rate of payment with respect to any commodity shall not exceed the amount by which the average farm price of the commodity is less than 75 per centum of the parity price.

In apportioning the funds among commodities, parity income for each commodity shall be considered a normal year's domestic consumption and exports (in the case of corn, that part of a normal year's domestic consumption and exports determined on the basis of the proportion that corn production in the commercial corn-producing area was of United States production during the five years 1928–32, inclusive) of such commodity times the parity price. In determining parity prices and farm prices for these commodities, that part of the marketing year ending January 31, 1939, shall be used. In case any person who is entitled to payment hereunder dies, becomes incompetent or disappears before receiving such payment or is succeeded by another who renders or completes the required performance, payment shall, without regard to any other provisions of law, be made as the Secretary of Agriculture may determine to be fair and reasonable in all the circumstances and provide by regulations. The administration of this title shall be in accordance with the provisions of the Agricultural Adjustment Act of 1938 and the provisions of other titles of this joint resolution shall not apply to this title.

This title may be cited as the "Price Adjustment Act of 1938." [11]

AGRICULTURAL ADJUSTMENT EXHIBITS [12]

In carrying into effect the provisions of the Soil Conservation and Domestic Allotment Act, as amended, and the Agricultural Adjustment Act of 1938, as amended, the Secretary of Agriculture is authorized to expend out of the appropriations available to carry into effect the provisions of said Acts, during the fiscal years 1938 and 1939, not to exceed $50,000 for the preparation and display of exhibits, including such displays at State, interstate, and international fairs within the United States.

RECONCENTRATION OF COTTON UNDER COMMODITY CREDIT CORPORATION LOAN [13]

That in the administration of section 383 (b) of the Agricultural Adjustment Act of 1938 the written consent of the producer or borrower to the reconcentration of any cotton held as security for any loan heretofore or hereafter made or arranged for by the Commodity Credit Corporation shall not be deemed to have been given unless such consent shall have been given in an instrument made solely for that purpose. Notwithstanding any provision of any loan agreement heretofore made, no cotton held under any such agreement as security for any such loan shall be moved from one warehouse to another unless the written consent of the producer or borrower shall have been obtained in a separate instrument given solely for that purpose, as required by this Act. The giving of written consent for the reconcentration of cotton shall not be made a condition upon the making of any loan hereafter made or arranged for by the Commodity Credit Corporation: *Provided, however*, That in cases where there is congestion and lack of storage facilities, and the local warehouse certifies such fact and requests the Commodity Credit Corporation to move the cotton for reconcentration to some other point, or when the Commodity Credit Corporation determines such loan cotton is improperly warehoused and subject to damage, or if uninsured, or if any of the terms of the loan agreement are violated, or if carrying charges are substantially in excess of the average of carrying charges available elsewhere, and the local warehouse, after notice, declines to reduce such charges, such written consent as provided in this amendment need not be obtained; and consent to movement under any of the conditions of this proviso may be required in future loan agreements.

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[11] Section 502 of the Price Adjustment Act of 1938 is omitted in this compilation since that section only contains amendments to section 302 of the Agricultural Adjustment Act of 1938. These amendments are shown in the Annotated Compilation of the Agricultural Adjustment Act of 1938, as amended, infra, pages 21, 22.

[12] The item entitled "Conservation and Use of Agricultural Land Resources, Department of Agriculture," contained in the Second Deficiency Appropriation Act, fiscal year 1938, approved June 25, 1938.

[13] The act entitled "An Act Relating to the manner of securing written consent for the reconcentration of cotton under section 383 (b) of the Agricultural Adjustment Act of 1938," approved June 16, 1938.

Exhibit 27.—ANNOTATED COMPILATION OF AGRICULTURAL MARKETING AGREEMENT ACT OF 1937 REENACTING, AMENDING, AND SUPPLEMENTING THE AGRICULTURAL ADJUSTMENT ACT, AS AMENDED [1]

PREFATORY NOTE

This compilation is intended to indicate the present status of legislation by Congress relating to marketing agreements and orders regulating the handling of agricultural commodities in interstate and foreign commerce. The Agricultural Marketing Agreement Act of 1937, approved June 3, 1937 (Public, No. 137—75th Congress—Chap. 296, 1st Session), reenacted and amended certain provisions of the Agricultural Adjustment Act, as amended, relating to marketing agreements and orders. Related legislation enacted prior to June 3, 1937, is given in the compilation known as "Annotated Compilation of the Agricultural Adjustment Act, as Amended, and Acts Relating Thereto at the Close of the First Session of the Seventy-Fourth Congress, August 26, 1935"; Superintendent of Documents, Washington, D. C.

Throughout the text of this compilation, bold face type is used for the language of the Agricultural Marketing Agreement Act of 1937; light face type is used for the language of the Agricultural Adjustment Act, as amended, as reenacted by the Agricultural Marketing Agreement Act of 1937; italics are used for amendments made by section 2 of the Agricultural Marketing Agreement Act of 1937 to the Agricultural Adjustment Act, as amended.

The provisions of section 2 of the Agricultural Marketing Agreement Act of 1937 are not set out haec verba. They are, however, incorporated in the body of the provisions of the Agricultural Adjustment Act, as amended, which they amend. References to the amendatory provisions of section 2 of the Agricultural Marketing Agreement Act of 1937 are contained in the annotations.

An act to reenact and amend provisions of the Agricultural Adjustment Act, as amended, relating to marketing agreements and orders

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following provisions of the Agricultural Adjustment Act, as amended, not having been intended for the control of the production of agricultural commodities, and having been intended to be effective irrespective of the validity of any other provision of that act, are expressly affirmed and validated, and are reenacted without change except as provided in section 2:

(a) Section 1 (relating to the declaration of emergency);

DECLARATION

It is hereby declared that the disruption of the orderly exchange of commodities in interstate commerce impairs the purchasing power of farmers and destroys the value of agricultural assets which support the national credit structure and that these conditions affect transactions in agricultural commodities with a national public interest, and burden and obstruct the normal channels of interstate commerce.[2]

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[1] For annotations to the Agricultural Adjustment Act, as amended; for provisions of that act not reenacted by the provisions of the Agricultural Marketing Agreement Act of 1937; and for other acts of Congress relating both to the Agricultural Adjustment Act, as amended, and to the Agricultural Marketing Agreement Act of 1937 see "Annotated Compilation of Agricultural Adjustment Act as Amended and Acts Relating Thereto at the Close of the First Session of the 74th Congress, August 26, 1935"; Superintendent of Documents, Washington, D. C.

[2] As amended by sec. 2 (a) of the Agricultural Marketing Agreement Act of 1937. The text of sec. 1 of the Agricultural Adjustment Act, as amended, was as follows:

"DECLARATION OF EMERGENCY

"That the present acute economic emergency being in part the consequence of a severe and increasing disparity between the prices of agricultural and other commodities, which disparity has largely destroyed the purchasing power of farmers for industrial products, has broken down the orderly exchange of commodities, and has seriously impaired the agricultural assets supporting the national credit structure, it is hereby declared that these conditions in the basic industry of agriculture have affected transactions in agricultural commodities with a national public interest, have burdened and obstructed the normal currents of commerce in such commodities, and render imperative the immediate enactment of title I of this Act."

(b) Section 2 (relating to declaration of policy);

DECLARATION OF POLICY

SEC. 2. It is hereby declared to be the policy of Congress—

(1) Through the exercise of the powers conferred upon the Secretary of Agriculture under this title, to establish and maintain such *orderly marketing conditions for agricultural commodities in interstate commerce as will establish*[3] prices to farmers at a level that will give agricultural commodities a purchasing power with respect to articles that farmers buy, equivalent to the purchasing power of agricultural commodities in the base period; and, in the case of all commodities for which the base period is the pre-war period, August 1909 to July 1914, will also reflect current interest payments per acre on farm indebtedness secured by real estate and tax payments per acre on farm real estate, as contrasted with such interest payments and tax payments during the base period. The base period in the case of all agricultural commodities except tobacco and potatoes shall be the pre-war period, August 1909–July 1914. In the case of tobacco and potatoes, the base period shall be the postwar period, August 1919–July 1929.

(2) To protect the interest of the consumer by (a) approaching the level of prices which it is declared to be the policy of Congress to establish in subsection (1) of this section by gradual correction of the current level at as rapid a rate as the Secretary of Agriculture deems to be in the public interest and feasible in view of the current consumptive demand in domestic and foreign markets, and (b) authorizing no action under this title which has for its purpose the maintenance of prices to farmers above the level which it is declared to be the policy of Congress to establish in subsection (1) of this section.

(c) Section 8a (5), (6), (7), (8), and (9) relating to violations and enforcement;

SEC. 8a (5) Any person willfully exceeding any quota or allotment fixed for him under this title by the Secretary of Agriculture, and any other person knowingly participating, or aiding, in the exceeding of said quota or allotment, shall forfeit to the United States a sum equal to three times the current market value of such excess, which forfeiture shall be recoverable in a civil suit brought in the name of the United States.

(6) The several district courts of the United States are hereby vested with jurisdiction specifically to enforce, and to prevent and restrain any person from violating[4] any order, regulation, or agreement, heretofore or hereafter made or issued pursuant to this title, in any proceeding now pending or hereafter brought in said courts.

(7) Upon the request of the Secretary of Agriculture, it shall be the duty of the several district attorneys of the United States, in their respective districts, under the directions of the Attorney General, to institute proceedings to enforce the remedies and to collect the forfeitures provided for in, or pursuant to, this title. Whenever the Secretary, or such officer or employee of the Department of Agriculture as he may designate for the purpose, has reason to believe that any handler has violated, or is violating, the provisions of any order or amendment thereto issued pursuant to this title, the Secretary shall have power to institute an investigation and, after due notice to such handler, to conduct a hearing in order to determine the facts for the purpose of referring the matter to the Attorney General for appropriate action.

(8) The remedies provided for in this section shall be in addition to, and not exclusive of, any of the remedies or penalties provided for elsewhere in this title or now or hereafter existing at law or in equity.

(9) The term "person" as used in this title includes an individual, partnership, corporation, association, and any other business unit.

(d) Section 8b (relating to marketing agreements);

SEC. 8b. In order to effectuate the declared policy of this title, the Secretary of Agriculture shall have the power, after due notice and opportunity for hear-

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[3] The italicized words were substituted by sec. 2 (b) of the Agricultural Marketing Agreement Act of 1937 in lieu of the words "balance between the production and consumption of agricultural commodities, and such marketing conditions therefor, as will reestablish."

[4] The following was deleted by section 2 (c) of the Agricultural Marketing Agreement Act of 1937: ", the provisions of this section, or of".

ing, to enter into marketing agreements with processors, producers, associations of producers, and others engaged in the handling of any agricultural commodity or product thereof, only with respect to such handling as is in the current of interstate or foreign commerce or which directly burdens, obstructs, or affects, interstate or foreign commerce in such commodity or product thereof. The making of any such agreement shall not be held to be in violation of any of the antitrust laws of the United States, and any such agreement shall be deemed to be lawful: *Provided*, That no such agreement shall remain in force after the termination of this Act. For the purpose of carrying out any such agreement the parties thereto shall be eligible for loans from the Reconstruction Finance Corporation under section 5 of the Reconstruction Finance Corporation Act. Such loans shall not be in excess of such amounts as may be authorized by the agreements.

(e) Section 8c (relating to orders);

ORDERS

SEC. 8c. (1) The Secretary of Agriculture shall, subject to the provisions of this section, issue, and from time to time amend, orders applicable to processors, associations of producers, and others engaged in the handling of any agricultural commodity or product thereof specified in subsection (2) of this section. Such persons are referred to in this title as "handlers." Such orders shall regulate, in the manner hereinafter in this section provided, only such handling of such agricultural commodity, or product thereof, as is in the current of interstate or foreign commerce, or which directly burdens, obstructs, or affects, interstate or foreign commerce in such commodity or product thereof.

COMMODITIES TO WHICH APPLICABLE

(2) Orders issued pursuant to this section shall be applicable only to the following agricultural commodities and the products thereof (except products of naval stores), or to any regional, or market classification of any such commodity or product: Milk, fruits (including pecans and walnuts but not including apples and not including fruits, other than olives, for canning), tobacco, vegetables (not including vegetables, other than asparagus, for canning) soybeans and naval stores as included in the Naval Stores Act and standards established thereunder (including refined or partially refined oleoresin).

NOTICE AND HEARING

(3) Whenever the Secretary of Agriculture has reason to believe that the issuance of an order will tend to effectuate the declared policy of this title with respect to any commodity or product thereof specified in subsection (2) of this section, he shall give due notice of and an opportunity for a hearing upon a proposed order.

FINDING AND ISSUANCE OF ORDER

(4) After such notice and opportunity for hearing, the Secretary of Agriculture shall issue an order if he finds, and sets forth in such order, upon the evidence introduced at such hearing (in addition to such other findings as may be specifically required by this section) that the issuance of such order and all of the terms and conditions thereof will tend to effectuate the declared policy of this title with respect to such commodity.

TERMS—MILK AND ITS PRODUCTS

(5) In the case of milk and its products, orders issued pursuant to this section shall contain one or more of the following terms and conditions, and (except as provided in subsection (7)) no others:

(A) Classifying milk in accordance with the form in which or the purpose for which it is used, and fixing, or providing a method for fixing, minimum prices for each such use classification which all handlers shall pay, and the time when payments shall be made, for milk purchased from producers or associations of producers. Such prices shall be uniform as to all handlers, subject only to adjustments for (1) volume, market, and production differentials

customarily applied by the handlers subject to such order, (2) the grade or quality of the milk purchased, and (3) the locations at which delivery of such milk, or any use classification thereof, is made to such handlers.

(B) Providing:

(i) for the payment to all producers and associations of producers delivering milk to the same handler of uniform prices for all milk delivered by them: *Provided*, That, except in the case of orders covering milk products only, such provision is approved or favored by at least three-fourths of the producers who, during a representative period determined by the Secretary of Agriculture, have been engaged in the production for market of milk covered in such order or by producers who, during such representative period, have produced at least three-fourths of the volume of such milk produced for market during such period; the approval required hereunder shall be separate and apart from any other approval or disapproval provided for by this section; or

(ii) for the payment to all producers and associations of producers delivering milk to all handlers of uniform prices for all milk so delivered, irrespective of the uses made of such milk by the individual handler to whom it is delivered;

subject, in either case, only to adjustments for (a) volume, market, and production differentials customarily applied by the handlers subject to such order, (b) the grade or quality of the milk delivered, (c) the locations at which delivery of such milk is made, and (d) a further adjustment, equitably to apportion the total value of the milk purchased by any handler, or by all handlers, among producers and associations of producers, on the basis of their *marketings*[5] of milk during a representative period of time.

(C) In order to accomplish the purposes set forth in paragraphs (A) and (B) of this subsection (5), providing a method for making adjustments in payments, as among handlers (including producers who are also handlers), to the end that the total sums paid by each handler shall equal the value of the milk purchased by him at the prices fixed in accordance with paragraph (A) hereof.

(D) Providing that, in the case of all milk purchased by handlers from any producer who did not regularly sell milk during a period of 30 days next preceding the effective date of such order for consumption in the area covered thereby, payments to such producer, for the period beginning with the first regular delivery by such producer and continuing until the end of two full calendar months following the first day of the next succeeding calendar month, shall be made at the price for the lowest use classification specified in such order, subject to the adjustments specified in paragraph (B) of this subsection (5).

(E) Providing (i) except as to producers for whom such services are being rendered by a cooperative marketing association, qualified as provided in paragraph (F) of this subsection (5), for market information to producers and for the verification of weights, sampling, and testing of milk purchased from producers, and for making appropriate deductions therefor from payments to producers, and (ii) for assurance of, and security for, the payment by handlers for milk purchased.

(F) Nothing contained in this subsection (5) is intended or shall be construed to prevent a cooperative marketing association qualified under the provisions of the Act of Congress of February 18, 1922, as amended, known as the "Capper-Volstead Act", engaged in making collective sales or marketing of milk or its products for the producers thereof, from blending the net proceeds of all its sales in all markets in all use classifications, and making distribution thereof to its producers in accordance with the contract between the association and its producers: *Provided*, That it shall not sell milk or its products to any handler for use or consumption in any market at prices less than the prices fixed pursuant to paragraph (A) of this subsection (5) for such milk.

(G) No marketing agreement or order applicable to milk and its products in any marketing area shall prohibit or in any manner limit, in the case of the products of milk, the marketing in that area of any milk or product thereof produced in any production area in the United States.

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[5] The word "production" was deleted and the word "marketings" was substituted by section 2 (d) of the Agricultural Marketing Agreement Act of 1937.

TERMS—OTHER COMMODITIES

(6) In the case of fruits (including pecans and walnuts but not including apples and not including fruits, other than olives, for canning) and their products, tobacco and its products, vegetables (not including vegetables, other than asparagus, for canning) and their products, soybeans and their products, and naval stores as included in the Naval Stores Act and standards established thereunder (including refined or partially refined oleoresin), orders issued pursuant to this section shall contain one or more of the following terms and conditions, and (except as provided in subsection (7)) no others:

(A) Limiting, or providing methods for the limitation of, the total quantity of any such commodity or product, or of any grade, size, or quality thereof, produced during any specified period or periods, which may be marketed in or transported to any or all markets in the current of interstate or foreign commerce or so as directly to burden, obstruct, or affect interstate or foreign commerce in such commodity or product thereof, during any specified period or periods by all handlers thereof.

(B) Allotting, or providing methods for allotting, the amount of such commodity or product, or any grade, size, or quality thereof, which each handler may purchase from or handle on behalf of any and all producers thereof, during any specified period or periods, under a uniform rule based upon the amounts[6] sold by such producers in such prior period as the Secretary determines to be representative, or upon the current *quantities available for sale by*[7] such producers, or both, to the end that the total quantity thereof to be purchased or handled during any specified period or periods shall be apportioned equitably among producers.

(C) Allotting, or providing methods for allotting, the amount of any such commodity or product, or any grade, size, or quality thereof, which each handler may market in or transport to any or all markets in the current of interstate or foreign commerce or so as directly to burden, obstruct, or affect interstate or foreign commerce in such commodity or product thereof, under a uniform rule based upon the amounts which each such handler has available for current shipment, or upon the amounts shipped by each such handler in such prior period as the Secretary determines to be representative, or both, to the end that the total quantity of such commodity or product, or any grade, size, or quality thereof, to be marketed in or transported to any or all markets in the current of interstate or foreign commerce or so as directly to burden, obstruct, or affect interstate or foreign commerce in such commodity or product thereof, during any specified period or periods shall be equitably apportioned among all of the handlers thereof.

(D) Determining, or providing methods for determining, the existence and extent of the surplus of any such commodity or product, or of any grade, size, or quality thereof, and providing for the control and disposition of such surplus, and for equalizing the burden of such surplus elimination or control among the producers and handlers thereof.

(E) Establishing, or providing for the establishment of, reserve pools of any such commodity or product, or of any grade, size, or quality thereof, and providing for the equitable distribution of the net return derived from the sale thereof among the persons beneficially interested therein.

TERMS COMMON TO ALL ORDERS

(7) In the case of the agricultural commodities and the products thereof specified in subsection (2) orders shall contain one or more of the following terms and conditions:

(A) Prohibiting unfair methods of competition and unfair trade practices in the handling thereof.

(B) Providing that (except for milk and cream to be sold for consumption in fluid form) such commodity or product thereof, or any grade, size, or quality thereof shall be sold by the handlers thereof only at prices filed by such handlers in the manner provided in such order.

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[6] The words "produced **or**" were deleted by section 2 (e) of the Agricultural Marketing Agreement Act of 1937.

[7] The italicized words were substituted by section 2 (e) of the Agricultural Marketing Agreement Act of 1937, in lieu of the words: "production or sales of."

(C) Providing for the selection by the Secretary of Agriculture, or a method for the selection, of an agency or agencies and defining their powers and duties, which shall include only the powers:

(i) To administer such order in accordance with its terms and provisions;

(ii) To make rules and regulations to effectuate the terms and provisions of such order;

(iii) To receive, investigate, and report to the Secretary of Agriculture complaints of violations of such order; and

(iv) To recommend to the Secretary of Agriculture amendments to such order.

No person acting as a member of an agency established pursuant to this paragraph (C) shall be deemed to be acting in an official capacity, within the meaning of section 10 (g) of this title, unless such person receives compensation for his personal services from funds of the United States.

(D) Incidental to, and not inconsistent with, the terms and conditions specified in subsections (5), (6), and (7) and necessary to effectuate the other provisions of such order.

ORDERS WITH MARKETING AGREEMENT

(8) Except as provided in subsection (9) of this section, no order issued pursuant to this section shall become effective until the handlers (excluding cooperative associations of producers who are not engaged in processing, distributing, or shipping the commodity or product thereof covered by such order) of not less than 50 per centum of the volume of the commodity or product thereof covered by such order which is produced or marketed within the production or marketing area defined in such order have signed a marketing agreement, entered into pursuant to section 8b of this title, which regulates the handling of such commodity or product in the same manner as such order, except that as to citrus fruits produced in any area producing what is known as California citrus fruits no order issued pursuant to this subsection (8) shall become effective until the handlers of not less than 80 per centum of the volume of such commodity or product thereof covered by such order have signed such a marketing agreement: Provided, That no order issued pursuant to this subsection shall be effective unless the Secretary of Agriculture determines that the issuance of such order is approved or favored:

(A) By at least two-thirds of the producers who (except that as to citrus fruits produced in any area producing what is known as California citrus fruits said order must be approved or favored by three-fourths of the producers), during a representative period determined by the Secretary, have been engaged, within the production area specified in such marketing agreement or order, in the production for market of the commodity specified therein, or who, during such representative period, have been engaged in the production of such commodity for sale in the marketing area specified in such marketing agreement, or order, or

(B) By producers who, during such representative period, have produced for market at least two-thirds of the volume of such commodity produced for market within the production area specified in such marketing agreement or order, or who, during such representative period, have produced at least two-thirds of the volume of such commodity sold within the marketing area specified in such marketing agreement or order.

ORDERS WITH OR WITHOUT MARKETING AGREEMENT

(9) Any order issued pursuant to this section shall become effective in the event that, notwithstanding the refusal or failure of handlers (excluding cooperative associations of producers who are not engaged in processing, distributing, or shipping the commodity or product thereof covered by such order) of more than 50 per centum of the volume of the commodity or product thereof (except that as to citrus fruits produced in any area producing what is known as California citrus fruits said per centum shall be 80 per centum) covered by such order which is produced or marketed within the production or marketing area defined in such order to sign a marketing agreement relating to such commodity or product thereof, on which a hearing has been held, the Secretary of Agriculture, with the approval of the President, determines:

(A) That the refusal or failure to sign a marketing agreement (upon which a hearing has been held) by the handlers (excluding cooperative associations of producers who are not engaged in processing, distributing, or shipping the commodity or product thereof covered by such order) of more than 50 per centum of the volume of the commodity or product thereof (except that as to citrus fruits produced in any area producing what is known as California citrus fruits said per centum shall be 80 per centum) specified therein which is produced or marketed within the production or marketing area specified therein tends to prevent the effectuation of the declared policy of this title with respect to such commodity or product; and

(B) That the issuance of such order is the only practical means of advancing the interests of the producers of such commodity pursuant to the declared policy, and is approved or favored:

(i) By at least two-thirds of the producers (except that as to citrus fruits produced in any area producing what is known as California citrus fruits said order must be approved or favored by three-fourths of the producers) who, during a representative period determined by the Secretary, have been engaged, within the production area specified in such marketing agreement or order, in the production for market of the commodity specified therein, or who, during such representative period, have been engaged in the production of such commodity for sale in the marketing area specified in such marketing agreement, or order; or

(ii) By producers who, during such representative period, have produced for market at least two-thirds of the volume of such commodity produced for market within the production area specified in such marketing agreement or order, or who, during such representative period, have produced at least two-thirds of the volume of such commodity sold within the marketing area specified in such marketing agreement or order.

MANNER OF REGULATION AND APPLICABILITY

(10) No order shall be issued under this section unless it regulates the handling of the commodity or product covered thereby in the same manner as, and is made applicable only to persons in the respective classes of industrial or commercial activity specified in, a marketing agreement upon which a hearing has been held. No order shall be issued under this title prohibiting, regulating, or restricting the advertising of any commodity or product covered thereby, nor shall any marketing agreement contain any provision prohibiting, regulating, or restricting the advertising of any commodity or product covered by such marketing agreement.

REGIONAL APPLICATION

(11) (A) No order shall be issued under this section which is applicable to all production areas or marketing areas, or both, of any commodity or product thereof unless the Secretary finds that the issuance of several orders applicable to the respective regional production areas or regional marketing areas, or both, as the case may be, of the commodity or product would not effectively carry out the declared policy of this title.

(B) Except in the case of milk and its products, orders issued under this section shall be limited in their application to the smallest regional production areas or regional marketing areas, or both, as the case may be, which the Secretary finds practicable, consistently with carrying out such declared policy.

(C) All orders issued under this section which are applicable to the same commodity or product thereof shall, so far as practicable, prescribe such different terms, applicable to different production areas and marketing areas, as the Secretary finds necessary to give due recognition to the differences in production and marketing of such commodity or product in such areas.

COOPERATIVE ASSOCIATION REPRESENTATION

(12) Whenever, pursuant to the provisions of this section, the Secretary is required to determine the approval or disapproval of producers with respect to the issuance of any order, or any term or condition thereof, or the termination thereof, the Secretary shall consider the approval or disapproval by any cooperative association of producers, bona fide engaged in marketing the

commodity or product thereof covered by such order, or in rendering services for or advancing the interests of the producers of such commodity, as the approval or disapproval of the producers who are members of, stockholders in, or under contract with, such cooperative association of producers.

RETAILER AND PRODUCER EXEMPTION

(13) (A) No order issued under subsection (9) of this section shall be applicable to any person who sells agricultural commodities or products thereof at retail in his capacity as such retailer, except to a retailer in his capacity as a retailer of milk and its products.

(B) No order issued under this title shall be applicable to any producer in his capacity as a producer.

VIOLATION OF ORDER

(14) Any handler subject to an order issued under this section, or any officer, director, agent, or employee of such handler, who violates any provision of such order (other than a provision calling for payment of a pro rata share of expenses) shall, on conviction, be fined not less than $50 or more than $500 for each such violation, and each day during which such violation continues shall be deemed a separate violation: *Provided*, That if the court finds that a petition pursuant to subsection (15) of this section was filed and prosecuted by the defendant in good faith and not for delay, no penalty shall be imposed under this subsection for such violations as occurred between the date upon which the defendant's petition was filed with the Secretary, and the date upon which notice of the Secretary's ruling thereon was given to the defendant in accordance with regulations prescribed pursuant to subsection (15).

PETITION BY HANDLER AND REVIEW

(15) (A) Any handler subject to an order may file a written petition with the Secretary of Agriculture, stating that any such order or any provision of any such order or any obligation imposed in connection therewith is not in accordance with law and praying for a modification thereof or to be exempted therefrom. He shall thereupon be given an opportunity for a hearing upon such petition, in accordance with regulations made by the Secretary of Agriculture, with the approval of the President. After such hearing, the Secretary shall make a ruling upon the prayer of such petition which shall be final, if in accordance with law.

(B) The District Courts of the United States (including the Supreme Court of the District of Columbia) in any district in which such handler is an inhabitant, or has his principal place of business, are hereby vested with jurisdiction in equity to review such ruling, provided a bill in equity for that purpose is filed within twenty days from the date of the entry of such ruling. Service of process in such proceedings may be had upon the Secretary by delivering to him a copy of the bill of complaint. If the court determines that such ruling is not in accordance with law, it shall remand such proceedings to the Secretary with directions either (1) to make such ruling as the court shall determine to be in accordance with law, or (2) to take such further proceedings as, in its opinion, the law requires. The pendency of proceedings instituted pursuant to this subsection (15) shall not impede, hinder, or delay the United States or the Secretary of Agriculture from obtaining relief pursuant to section 8a (6) of this title. Any proceedings brought pursuant to section 8a (6) of this title (except where brought by way of counterclaim in proceedings instituted pursuant to this subsection (15)) shall abate whenever a final decree has been rendered in proceedings between the same parties, and covering the same subject matter, instituted pursuant to this subsection (15).

TERMINATION OF ORDERS AND MARKETING AGREEMENTS

(16) (A) The Secretary of Agriculture shall, whenever he finds that any order issued under this section, or any provision thereof, obstructs or does not tend to effectuate the declared policy of this title, terminate or suspend the operation of such order or such provision thereof.

(B) The Secretary shall terminate any marketing agreement entered into under section 8b, or order issued under this section, at the end of the then current marketing period for such commodity, specified in such marketing agree-

ment or order, whenever he finds that such termination is favored by a majority of the producers who, during a representative period determined by the Secretary, have been engaged in the production for market of the commodity specified in such marketing agreement or order, within the production area specified in such marketing agreement or order, or who, during such representative period, have been engaged in the production of such commodity for sale within the marketing area specified in such marketing agreement or order: *Provided*, That such majority have, during such representative period, produced for market more than 50 per centum of the volume of such commodity produced for market within the production area specified in such marketing agreement or order, or have, during such representative period, produced more than 50 per centum of the volume of such commodity sold in the marketing area specified in such marketing agreement or order, but such termination shall be effective only if announced on or before such date (prior to the end of the then current marketing period) as may be specified in such marketing agreement or order.

(C) The termination or suspension of any order or amendment thereto or provision thereof, shall not be considered an order within the meaning of this section.

PROVISIONS APPLICABLE TO AMENDMENTS

(17) The provisions of this section, section 8d, and section 8e applicable to orders shall be applicable to amendments to orders: Provided, That notice of a hearing upon a proposed amendment to any order issued pursuant to section 8c, given not less than three days prior to the date fixed for such hearing, shall be deemed due notice thereof.

MILK PRICES

(*18*) *The Secretary of Agriculture, prior to prescribing any term in any marketing agreement or order, or amendment thereto, relating to milk or its products, if such terms is to fix minimum prices to be paid to producers or associations of producers, or prior to modifying the price fixed in any such term, shall ascertain, in accordance with section 2 and section 8e, the prices that will give such commodities a purchasing power equivalent to their purchasing power during the base period. The level of prices which it is declared to be the policy of Congress to establish in section 2 and section 8e shall, for the purposes of such agreement, order, or amendment, be such level as will reflect the price of feeds, the available supplies of feeds, and other economic conditions which affect market supply and demand, for milk or its products in the marketing area to which the contemplated marketing agreement, order, or amendment relates. Whenever the Secretary finds, upon the basis of the evidence adduced at the hearing required by section 8b or 8c, as the case may be, that the prices that will give such commodities a purchasing power equivalent to their purchasing power during the base period as determined pursuant to section 2 and section 8e are not reasonable in view of the price of feeds, the available supplies of feeds, and other economic conditions which affect market supply and demand for milk and its products in the marketing area to which the contemplated agreement, order, or amendment relates, he shall fix such prices as he finds will reflect such factors, insure a sufficient quantity of pure and wholesome milk, and be in the public interest. Thereafter, as the Secretary finds necessary on account of changed circumstances, he shall, after due notice and opportunity for hearing, make adjustments in such prices.*[8]

PRODUCER REFERENDUM

(*19*) *For the purpose of ascertaining whether the issuance of an order is approved or favored by producers, as required under the applicable provisions of this title, the Secretary may conduct a referendum among producers. The requirements of approval or favor under any such provision shall be held to be complied with if, of the total number of producers, or the total volume of production, as the case may be, represented in such referendum, the percentage approving or favoring is equal to or in excess of the percentage required under such provision. Nothing in this subsection shall be construed as limiting representation by cooperative associations as provided in subsection (12).*[9]

[8] This italicized subsection was added by sec. 2 (f) of the Agricultural Marketing Agreement Act of 1937.

[9] This italicized subsection was added by sec. 2 (f) of the Agricultural Marketing Agreement Act of 1937.

(f) Section 8d (relating to books and records);

BOOKS AND RECORDS

SEC. 8d. (1) All parties to any marketing agreement, and all handlers subject to an order, shall severally, from time to time, upon the request of the Secretary, furnish him with such information as he finds to be necessary to enable him to ascertain and determine the extent to which such agreement or order has been carried out or has effectuated the declared policy of this title, and with such information as he finds to be necessary to determine whether or not there has been any abuse of the privilege of exemptions from the antitrust laws. Such information shall be furnished in accordance with forms of reports to be prescribed by the Secretary. For the purpose of ascertaining the correctness of any report made to the Secretary pursuant to this subsection, or for the purpose of obtaining the information required in any such report, where it has been requested and has not been furnished, the Secretary is hereby authorized to examine such books, papers, records, copies of income-tax reports, accounts, correspondence, contracts, documents, or memoranda, as he deems relevant and which are within the control (1) of any such party to such marketing agreement, or any such handler, from whom such report was requested, or (2) of any person having, either directly or indirectly, actual or legal control of or over such party or such handler, or (3) of any subsidiary of any such party, handler, or person.

(2) Notwithstanding the provisions of section 7, all information furnished to or acquired by the Secretary of Agriculture pursuant to this section shall be kept confidential by all officers and employees of the Department of Agriculture and only such information so furnished or acquired as the Secretary deems relevant shall be disclosed by them, and then only in a suit or administrative hearing brought at the direction, or upon the request, of the Secretary of Agriculture, or to which he or any officer of the United States is a party, and involving the marketing agreement or order with reference to which the information so to be disclosed was furnished or acquired. Nothing in this section shall be deemed to prohibit (A) the issuance of general statements based upon the reports of a number of parties to a marketing agreement or of handlers subject to an order, which statements do not identify the information furnished by any person, or (B) the publication by direction of the Secretary, of the name of any person violating any marketing agreement or any order, together with a statement of the particular provisions of the marketing agreement or order violated by such person. Any such officer or employee violating the provisions of this section shall upon conviction be subject to a fine of not more than $1,000 or to imprisonment for not more than one year, or to both, and shall be removed from office.

(g) Section 8e (relating to determination of base period);

DETERMINATION OF BASE PERIOD

SEC. 8e. In connection with the making of any marketing agreement or the issuance of any order, if the Secretary finds and proclaims that, as to any commodity specified in such marketing agreement or order, the purchasing power during the base period specified for such commodity in section 2 of this title cannot be satisfactorily determined from available statistics of the Department of Agriculture, the base period, for the purposes of such marketing agreement or order, shall be the post-war period, August 1919–July 1929, or all that portion thereof for which the Secretary finds and proclaims that the purchasing power of such commodity can be satisfactorily determined from available statistics of the Department of Agriculture.

(h) Section 10 (a), (b) (2), (c), (f), (g), (h), and (i) (miscellaneous provisions);

MISCELLANEOUS

SEC. 10. (a) The Secretary of Agriculture may appoint such officers and employees, subject to the provisions of the Classification Act of 1923 and Acts amendatory thereof, and such experts as are necessary to execute the functions vested in him by this title; and the Secretary may make such appointments without regard to the civil service laws or regulations: *Provided*, That no salary in excess of $10,000 per annum shall be paid to any officer, employee, or

expert of the Agricultural Adjustment Administration, which the Secretary shall establish in the Department of Agriculture for the administration of the functions vested in him by this title: *And provided further,* That the State Administrator appointed to administer this Act in each State shall be appointed by the President, by and with the advice and consent of the Senate. Title H of the Act entitled "An Act to maintain the credit of the United States Government," approved March 20, 1933, to the extent that it provides for the impoundment of appropriations on account of reductions in compensation, shall not operate to require such impoundment under appropriations contained in this Act.

(b) (2)[10] Each order issued by the Secretary under this title shall provide that each handler subject thereto shall pay to any authority or agency established under such order such handler's pro rata share (as approved by the Secretary) of such expenses as the Secretary may find will necessarily be incurred by such authority or agency, during any period specified by him, for the maintenance and functioning of such authority or agency, other than expenses incurred in receiving, handling, holding, or disposing of any quantity of a commodity received, handled, held, or disposed of by such authority or agency for the benefit or account of persons other than handlers subject to such order. The pro rata share of the expenses payable by a cooperative association of producers shall be computed on the basis of the quantity of the agricultural commodity or product thereof covered by such order which is distributed, processed, or shipped by such cooperative association of producers. Any such authority or agency may maintain in its own name, or in the names of its members, a suit against any handler subject to an order for the collection of such handler's pro rata share of expenses. The several District Courts of the United States are hereby vested with jurisdiction to entertain such suits regardless of the amount in controversy.

(c) The Secretary of Agriculture is authorized, with the approval of the President, to make such regulations with the force and effect of law as may be necessary to carry out the powers vested in him by this title.[11] Any violation of any regulation shall be subject to such penalty, not in excess of $100, as may be provided therein.

(f) The provisions of this title shall be applicable to the United States and its possessions, except the Philippine Islands, the Virgin Islands, American Samoa, the Canal Zone, and the island of Guam; except that, in the case of sugar beets and sugarcane, the President, if he finds it necessary in order to effectuate the declared policy of this Act, is authorized by proclamation to make the provisions of this title applicable to the Philippine Islands, the Virgin Islands, American Samoa, the Canal Zone, and/or the island of Guam.[12]

(g) No person shall, while acting in any official capacity in the administration of this title, speculate, directly or indirectly, in any agricultural commodity or product thereof, to which this title applies, or in contracts relating thereto, or in the stock or membership interests of any association or corporation engaged in handling, processing, or disposing of any such commodity or product. Any person violating this subsection shall upon conviction thereof be fined not more than $10,000 or imprisoned not more than two years, or both.

(h) For the efficient administration of the provisions of part 2 of this title, the provisions, including penalties, of sections 8, 9, and 10 of the Federal Trade Commission Act, approved September 26, 1914, are made applicable to the jurisdiction, powers, and duties of the Secretary in administering the provisions of this title and to any person subject to the provisions of this title, whether or not a corporation. Hearings authorized or required under this title shall be conducted by the Secretary of Agriculture or such officer or employee of the Department as he may designate for the purpose. The Secretary may report any violation of any agreement entered into under part 2 of this title to the Attorney General of the United States, who shall cause appropriate proceedings to enforce such agreement to be commenced and prosecuted in the proper courts of the United States without delay.

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[10] Sec. 10 (b) (2) of the Agricultural Adjustment Act, as amended.

[11] Sec. 2 (g) of the Agricultural Marketing Agreement Act of 1937 deletes the following: ", including regulations establishing conversion factors for any commodity and article processed therefrom to determine the amount of tax imposed or refunds to be made with respect thereto."

[12] Sec. 2 (h) of the Agricultural Marketing Agreement Act of 1937 deletes the sentence: "The President is authorized to attach by Executive order any or all such possessions to any internal-revenue collection district for the purpose of carrying out the provisions of this title with respect to the collection of taxes."

(i) The Secretary of Agriculture upon the request of the duly constituted authorities of any State is directed, in order to effectuate the declared policy of this title and in order to obtain uniformity in the formulation, administration, and enforcement of Federal and State programs relating to the regulation of the handling of agricultural commodities or products thereof, to confer with and hold joint hearings with the duly constituted authorities of any State, and is authorized to cooperate with such authorities; to accept and utilize, with the consent of the State, such State and local officers and employees as may be necessary: to avail himself of the records and facilities of such authorities; to issue orders (subject to the provisions of section 8c) complementary to orders or other regulations issued by such authorities; and to make available to such State authorities the records and facilities of the Department of Agriculture: *Provided*, That information furnished to the Secretary of Agriculture pursuant to section 8d (1) hereof shall be made available only to the extent that such information is relevant to transactions within the regulatory jurisdiction of such authorities, and then only upon a written agreement by such authorities that the information so furnished shall be kept confidential by them in a manner similar to that required of Federal officers and employees under the provisions of section 8d (2) hereof.

(j) The term "interstate or foreign commerce" means commerce between any State, Territory, or possession, or the District of Columbia, and any place outside thereof; or between points within the same State, Territory, or possession, or the District of Columbia, but through any place outside thereof; or within any Territory or possession, or the District of Columbia. For the purpose of this Act (but in nowise limiting the foregoing definition) a marketing transaction in respect to an agricultural commodity or the product thereof shall be considered in interstate or foreign commerce if such commodity or product is part of that current of interstate or foreign commerce usual in the handling of the commodity or product whereby they, or either of them, are sent from one State to end their transit, after purchase, in another, including all cases where purchase or sale is either for shipment to another State or for the processing within the State and the shipment outside the State of the products so processed. Agricultural commodities or products thereof normally in such current of interstate or foreign commerce shall not be considered out of such current through resort being had to any means or device intended to remove transactions in respect thereto from the provisions of this Act. As used herein, the word "State" includes Territory, the District of Columbia, possession of the United States, and foreign nations.[13]

(i) Section 12 (a) and (c) (relating to appropriation and expense);

APPROPRIATION

SEC. 12. (a) There is hereby appropriated, out of any money in the Treasury not otherwise appropriated, the sum of $100,000,000 to be available to the Secretary of Agriculture for administrative expenses under this title and for payments authorized to be made under section 8. Such sum shall remain available until expended.

To enable the Secretary of Agriculture to finance, under such terms and conditions as he may prescribe, surplus reductions[14] with respect to the dairy- and beef-cattle industries, and to carry out any of the purposes described in subsections (a) and (b) of this section (12) and to support and balance the market for the dairy and beef cattle industries, there is authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, the sum of $200,000,000: *Provided*, That not more than 60 per centum of such amount shall be used for either of such industries.

(c) The administrative expenses provided for under this section shall include, among others, expenditures for personal services and rent in the District of Columbia and elsewhere, for law books and books of reference, for contract stenographic reporting services, and for printing and paper in addition to allotments under the existing law. The Secretary of Agriculture shall transfer to the Treasury Department, and is authorized to transfer to other agencies, out of funds available for administrative expenses under this title, such sums as are

[13] This italicized subsection was added by sec. 2 (i) of the Agricultural Marketing Agreement Act of 1937.

[14] Sec. 2 (j) of the Agricultural Marketing Agreement Act of 1937 deletes the words: "and production adjustments."

required to pay administrative expenses incurred and refunds made by such department or agencies in the administration of this title.

(j) Section 14 (relating to separability);

SEPARABILITY OF PROVISIONS

SEC. 14. If any provision of this title is declared unconstitutional, or the applicability thereof to any person, circumstance, or commodity is held invalid the validity of the remainder of this title and the applicability thereof to other persons, circumstances, or commodities shall not be affected thereby.

(k) Section 22 (relating to imports);

IMPORTS

SEC. 22. (a) Whenever the President has reason to believe that any one or more articles are being imported into the United States under such conditions and in sufficient quantities as to render or tend to render ineffective or materially interfere with any program or operation undertaken, or to reduce substantially the amount of any product processed in the United States from any commodity subject to and with respect to which any program is in operation, under this title, or the Soil Conservation and Domestic Allotment Act, as amended, he shall cause an immediate investigation to be made by the United States Tariff Commission, which shall give precedence to investigations under this section to determine such facts. Such investigation shall be made after due notice and opportunity for hearing to interested parties and shall be conducted subject to such regulations as the President shall specify.

(b) If, on the basis of such investigation and report to him of findings and recommendations made in connection therewith, the President finds the existence of such facts, he shall by proclamation impose such limitations on the total quantities of any article or articles which may be imported as he finds and declares shown by such investigation to be necessary to prescribe in order that the entry of such article or articles will not render or tend to render ineffective or materially interfere with any program or operation undertaken, or will not reduce substantially the amount of any product processed in the United States from any commodity subject to and with respect to which any program is in operation under this title or the Soil Conservation and Domestic Allotment Act, as amended: *Provided*, That no limitation shall be imposed on the total quantity of any article which may be imported from any country which reduces such permissible total quantity to less than 50 per centum of the average annual quantity of such article which was imported from such country during the period from July 1, 1928, to June 30, 1933, both dates inclusive.

(c) No import restriction proclaimed by the President under this section nor any revocation, suspension, or modification thereof shall become effective until fifteen days after the date of such proclamation, revocation, suspension, or modification.

(d) Any decision of the President as to facts under this section shall be final.

(e) After investigation, report, finding, and declaration in the manner provided in the case of a proclamation issued pursuant to subsection (b) of this section, any proclamation or provision of such proclamation may be suspended by the President whenever he finds that the circumstances requiring the proclamation or provision thereof no longer exists, or may be modified by the President whenever he finds that changed circumstances require such modification to carry out the purposes of this section.[15]

SEC. 2. The following provisions, reenacted in section 1 of this act, are amended as follows: [16]

SEC. 3. (a) The Secretary of Agriculture, or such officer or employee of the Department of Agriculture as may be designated by him, upon written application of any cooperative association, incorporated or otherwise, which is in good faith owned or controlled by producers or organizations thereof, of milk

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[15] Sec. 5 of Public, No. 461, 74th Cong., approved February 29, 1936, amended sec. 22 of the Agricultural Adjustment Act, as amended, by inserting after the words "this title," wherever they appeared, the words "or the Soil Conservation and Domestic Allotment Act, as amended,"; and by deleting the words "an adjustment," wherever they appeared, and inserting in lieu thereof the word "any."

[16] Subsections (a) to (j), inclusive, of section 2 of the Agricultural Marketing Agreement Act of 1937 are incorporated in the preceding text and in footnotes 2 to 9, inclusive, and 11 to 14, inclusive, supra.

or its products, and which is bona fide engaged in collective processing or preparing for market or handling or marketing (in the current of interstate or foreign commerce, as defined by paragraph (i) of section 2 of this act), milk or its products, may mediate and, with the consent of all parties, shall arbitrate if the Secretary has reason to believe that the declared policy of the Agricultural Adjustment Act, as amended, would be effectuated thereby, bona-fide disputes, between such associations and the purchasers or handlers or processors or distributors of milk or its products, as to terms and conditions of the sale of milk or its products. The power to arbitrate under this section shall apply only to such subjects of the term or condition in dispute as could be regulated under the provisions of the Agricultural Adjustment Act, as amended, relating to orders for milk and its products.

(b) Meetings held pursuant to this section shall be conducted subject to such rules and regulations as the Secretary may prescribe.

(c) No award or agreement resulting from any such arbitration or mediation shall be effective unless and until approved by the Secretary of Agriculture, or such officer or employee of the Department of Agriculture as may be designated by him, and shall not be approved if it permits any unlawful trade practice or any unfair method of competition.

(d) No meeting so held and no award or agreement so approved shall be deemed to be in violation of any of the antitrust laws of the United States.

Sec. 4. Nothing in this act shall be construed as invalidating any marketing agreement, license, or order, or any regulation relating to, or any provision of, or any act of the Secretary of Agriculture in connection with, any such agreement, license, or order which has been executed, issued, approved, or done under the Agricultural Adjustment Act, or any amendment thereof, but such marketing agreements, licenses, orders, regulations, provisions, and acts are hereby expressly ratified, legalized, and confirmed.

Sec. 5. No processing taxes or compensating taxes shall be levied or collected under the Agricultural Adjustment Act, as amended. Except as provided in the preceding sentence, nothing in this act shall be construed as affecting provisions of the Agricultural Adjustment Act, as amended, other than those enumerated in section 1. The provisions so enumerated shall apply in accordance with their terms (as amended by this act) to the provisions of the Agricultural Adjustment Act, this act, and other provisions of law to which they have been heretofore made applicable.

Sec. 6. This act may be cited as the "Agricultural Marketing Agreement Act of 1937."

Exhibit 28.—PRESIDENT ROOSEVELT'S MESSAGE TO CONGRESS ON SUGAR LEGISLATION

To the Congress of the United States:

The expiration on December 31, 1937, of the quota provisions of the Jones-Costigan Act and Public Resolution No. 109 of June 19, 1936, and the existence of the public problems which have arisen as a result of discontinuance of the processing tax on sugar and benefit payments to sugar beet and sugarcane producers, make it desirable that the Congress consider the enactment of new legislation with respect to sugar. The Jones-Costigan Act has been useful and effective and it is my belief that its principles should again be made effective.

I therefore recommend to the Congress the enactment of the sugar quota system, and its necessary complements, which will restore the operation of the principles on which the Jones-Costigan Act was based. In order to accomplish this purpose adequate safeguards would be required to protect the interests of each group concerned. As a safeguard for the protection of consumers I recommend that provision be made to prevent any possible restriction of the supply of sugar that would result in prices to consumers in excess of those reasonably necessary, together with conditional payments to producers, to maintain the domestic industry as a whole and to make the production of sugar beets and sugarcane as profitable as the production of the principal other agricultural crops. In order to protect the expansion of markets for American exports, I recommend that no decrease be made in the share of other countries in the total quotas.

It is also highly desirable to continue the policy, which was inherent in the Jones-Costigan Act, of effectuating the principle that an industry which desires the protection afforded by a quota system, or a tariff, should be expected

to guarantee that it will be a good employer. I recommend, therefore, that the prevention of child labor, and the payment of wages of not less than minimum standards, be included among the conditions for receiving a Federal payment.

I recommend that adequate provision be made to protect the right of both new and old producers of small acreages of sugar beets and sugarcane to an equitable share of the benefits offered by the program. In this connection I suggest also that you consider the advisability of providing for payments at rates for family-size farms higher than those applicable to large operating units.

Quotas influence the price of sugar through the control of supply; consequently, under a quota regulation of the supply of sugar, a tax may be levied without causing any adverse effect, over a period of time, on the price paid by consumers.

I recommend to the Congress the enactment of an excise tax at the rate of not less than .75 cent per pound of sugar, raw value. I am definitely advised that such a tax would not increase the average cost of sugar to consumers. An excise tax of this amount would yield approximately $100,000,000 per annum to the Treasury of the United States, which would make the total revenue from sugar more nearly commensurate with that obtained during the period 1922–1929. It is also estimated that the total income of foreign countries from the sale of sugar in the United States under the quota system would not be less than that obtained during 1935, and, like the total income of domestic sugar producers, it can be expected to increase in future years as our consumption requirements expand.

In considering the enactment of any tax the Congress has regard for its social and economic effects as well as its ability to raise revenue. The social and economic effects of an adequate excise tax on sugar are so important to the welfare of the various groups affected as to constitute a necessary complement to the quota system. For this reason I recommend that neither the quotas nor the tax should be operative alone.

FRANKLIN D. ROOSEVELT

THE WHITE HOUSE,
March 1, 1937.

Exhibit 29.—THE SUGAR ACT OF 1937

An act to regulate commerce among the several States, with the Territories and possessions of the United States, and with foreign countries; to protect the welfare of consumers of sugars and of those engaged in the domestic sugar-producing industry; to promote the export trade of the United States; to raise revenue; and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the Sugar Act of 1937.

TITLE I—DEFINITIONS

SECTION 101. For the purposes of this Act, except title IV—

(a) The term "person" means an individual, partnership, corporation, or association.

(b) The term "sugars" means any grade or type of saccharine product derived from sugarcane or sugar beets, which contains sucrose, dextrose, or levulose.

(c) The term "sugar" means raw sugar or direct-consumption sugar.

(d) The term "raw sugar" means any sugars which are principally of crystalline structure and which are to be further refined or improved in quality, and any sugars which are principally not of crystalline structure but which are to be further refined or otherwise improved in quality to produce any sugars principally of crystalline structure.

(e) The term "direct-consumption sugar" means any sugars which are principally of crystalline structure and which are not to be further refined or otherwise improved in quality.

(f) The term "liquid sugar" means any sugars (exclusive of sirup of cane juice produced from sugarcane grown in continental United States) which are principally not of crystalline structure and which contain, or which are to be used for the production of any sugars principally not of crystalline structure which contain, soluble nonsugar solids (excluding any foreign substances that may have been added) equal to 6 per centum or less of the total soluble solids.

(g) Sugars in dry amorphous form shall be considered to be principally of crystalline structure.

(h) The "raw value" of any quantity of sugars means its equivalent in terms of ordinary commercial raw sugar testing ninety-six sugar degrees by the polariscope, determined in accordance with regulations to be issued by the Secretary. The principal grades and types of sugar and liquid sugar shall be translated into terms of raw value in the following manner:

(1) For direct-consumption sugar, derived from sugar beets and testing ninety-two or more sugar degrees by the polariscope, by multiplying the number of pounds thereof by 1.07;

(2) For sugar, derived from sugarcane and testing ninety-two sugar degrees by the polariscope, by multiplying the number of pounds thereof by 0.93;

(3) For sugar, derived from sugarcane and testing more than ninety-two sugar degrees by the polariscope, by multiplying the number of pounds thereof by the figure obtained by adding to 0.93 the result of multiplying 0.0175 by the number of degrees and fractions of a degree of polarization above ninety-two degrees;

(4) For sugar and liquid sugar, testing less than ninety-two sugar degrees by the polariscope, by dividing the number of pounds of the "total sugar content" thereof by 0.972.

(5) The Secretary may establish rates for translating sugar and liquid sugar into terms of raw value for (a) any grade or type of sugar or liquid sugar not provided for in the foregoing and (b) any special grade or type of sugar or liquid sugar for which he determines that the raw value cannot be measured adequately under the provisions of paragraph (1) to (4), inclusive, of this subsection (h).

(i) The term "total sugar content" means the sum of the sucrose (Clerget) and reducing or invert sugars contained in any grade or type of sugar or liquid sugar.

(j) The term "quota", depending upon the context, means (1) that quantity of sugar or liquid sugar which may be brought or imported into the continental United States, for consumption therein, during any calendar year, from the Territory of Hawaii, Puerto Rico, the Virgin Islands, the Commonwealth of the Philippine Islands, or a foreign country or group of foreign countries; (2) that quantity of sugar or liquid sugar produced from sugar beets or sugarcane grown in the continental United States which, during any calendar year, may be shipped, transported, or marketed in interstate commerce, or in competition with sugar or liquid sugar shipped, transported, or marketed in interstate or foreign commerce; or (3) that quantity of sugar or liquid sugar which may be marketed in the Territory of Hawaii or in Puerto Rico, for consumption therein, during any calendar year.

(k) The term "producer" means a person who is the legal owner, at the time of harvest or abandonment, of a portion or all of a crop of sugar beets or sugarcane grown on a farm for the extraction of sugar or liquid sugar.

(l) The terms "including" and "include" shall not be deemed to exclude anything not mentioned but otherwise within the meaning of the term defined.

(m) The term "Secretary" means the Secretary of Agriculture.

TITLE II.—QUOTA PROVISIONS

SEC. 201. The Secretary shall determine for each calendar year the amount of sugar needed to meet the requirements of consumers in the continental United States; such determinations shall be made during the month of December in each year for the succeeding calendar year and at such other times during such calendar year as the Secretary may deem necessary to meet such requirements. In making such determinations the Secretary shall use as a basis the quantity of direct-consumption sugar distributed for consumption, as indicated by official statistics of the Department of Agriculture, during the twelve-month period ending October 31 next preceding the calendar year for which the determination is being made, and shall make allowances for a deficiency or surplus in inventories of sugar, and changes in consumption, as computed from statistics published by agencies of the Federal Government with respect to inventories of sugar, population, and demand conditions; and in order that the regulation of commerce provided for under this Act shall not result in excessive prices to consumers, the Secretary may make such additional allowances as he may

deem necessary in the amount of sugar determined to be needed to meet the requirements of consumers, so that the supply of sugar made available under this Act shall not result in average prices to consumers in excess of those necessary to maintain the domestic sugar industry as a whole, and the amounts of such additional allowances shall be such that in no event will the amount of the total supply be less than the quantity of sugar required to give consumers of sugar in the continental United States a per capita consumption equal to that of the average of the two-year period 1935–1936.

SEC. 202. Whenever a determination is made, pursuant to section 201, of the amount of sugar needed to meet the requirements of consumers, the Secretary shall establish quotas, or revise existing quotas—

(a) For domestic sugar-producing areas by prorating among such areas 55.59 per centum of such amount of sugar (but not less than 3,715,000 short tons), on the following basis:

Area:	*Per centum*
Domestic beet sugar	41.72
Mainland cane sugar	11.31
Hawaii	25.25
Puerto Rico	21.48
Virgin Islands	.24

(b) For foreign countries, and the Commonwealth of the Philippine Islands, by prorating 44.41 per centum of such amount of sugar (except, if such amount of sugar is less than 6,682,670 short tons the excess of such amount over 3,715,000 short tons) on the following basis:

Area:	*Per centum*
Commonwealth of the Philippine Islands	34.70
Cuba	64.41
Foreign countries other than Cuba	.89

In no case shall the quota for the Commonwealth of the Philippine Islands be less than the duty-free quota now established by the provisions of the Philippine Independence Act.

The quota for foreign countries other than Cuba shall be prorated among such countries on the basis of the division of the quota for such countries made in General Sugar Quota Regulations, Series 4, Number 1, issued December 12, 1936, pursuant to the Agricultural Adjustment Act, as amended.

SEC. 203. In accordance with the applicable provisions of section 201, the Secretary shall also determine the amount of sugar needed to meet the requirements of consumers in the Territory of Hawaii, and in Puerto Rico, and shall establish quotas for the amounts of sugar which may be marketed for local consumption in such areas equal to the amounts determined to be needed to meet the requirements of consumers therein.

SEC. 204. (a) The Secretary shall, as he deems necessary during the calendar year, determine whether, in view of the current inventories of sugar, the estimated production from the acreage of sugarcane or sugar beets planted, the normal marketings within a calendar year of new-crop sugar, and other pertinent factors, any domestic area, the Commonwealth of the Philippine Islands, or Cuba, will be unable to market the quota for such area. If the Secretary finds that any domestic area or Cuba will be unable to market the quota for such area for the calendar year then current, he shall revise the quotas for the domestic areas and Cuba by prorating an amount of sugar equal to the deficit so determined to the other such areas, on the basis of the quotas then in effect. Any portion of such sugar which the Secretary determines cannot be supplied by domestic areas and Cuba shall be prorated to foreign countries other than Cuba on the basis of the prorations of the quota then in effect for such foreign countries. If the Secretary finds that the Commonwealth of the Philippine Islands will be unable to market the quota for such area for the calendar year then current, he shall revise the quota for foreign countries other than Cuba by prorating an amount of sugar equal to the deficit so determined to such foreign countries, on the basis of the prorations of the quota then in effect for such countries: *Provided, however,* That the quota for any domestic area, the Commonwealth of the Philippine Islands, or Cuba or other foreign countries, shall not be reduced by reason of any determination made pursuant to the provisions of this subsection.

(b) If, on the 1st day of September in any calendar year, any part or all of the proration to any foreign country of the quota in effect on the 1st day of

July in the same calendar year for foreign countries other than Cuba, has not been filled, the Secretary may revise the proration of such quota among such foreign countries, by prorating an amount of sugar equal to such unfilled proration to all other such foreign countries which have filled their prorations of such quota by such date, on the basis of the prorations then in effect.

SEC. 205. (a) Whenever the Secretary finds that the allotment of any quota, or proration thereof, established for any area pursuant to the provisions of this Act, is necessary to assure an orderly and adequate flow of sugar or liquid sugar in the channels of interstate or foreign commerce, or to prevent disorderly marketing or importation of sugar or liquid sugar, or to maintain a continuous and stable supply of sugar or liquid sugar, or to afford all interested persons an equitable opportunity to market sugar or liquid sugar within any area's quota, after such hearing and upon such notice as he may by regulations prescribe, he shall make allotments of such quota or proration thereof by allotting to persons who market or import sugar or liquid sugar, for such periods as he may designate, the quantities of sugar or liquid sugar which each such person may market in continental United States, the Territory of Hawaii, or Puerto Rico, or may import or bring into continental United States, for consumption therein. Allotments shall be made in such manner and in such amounts as to provide a fair, efficient, and equitable distribution of such quota or proration thereof, by taking into consideration the processings of sugar or liquid sugar from sugar beets or sugarcane to which proportionate shares, determined pursuant to the provisions of subsection (b) of section 302, pertained; the past marketings or importations of each such person; or the ability of such person to market or import that portion of such quota or proration thereof allotted to him. The Secretary may also, upon such hearing and notice as he may by regulations prescribe, revise or amend any such allotment upon the same basis as the initial allotment was made.

(b) An appeal may be taken, in the manner hereinafter provided, from any decision making such allotments, or revision thereof, to the United States Court of Appeals for the District of Columbia in any of the following cases:

(1) By any applicant for an allotment whose application shall have been denied.

(2) By any person aggrieved by reason of any decision of the Secretary granting or revising any allotment made to him.

(c) Such appeal shall be taken by filing with said court within twenty days after the decision complained of is effective, notice in writing of said appeal and a statement of the reasons therefor, together with proof of service of a true copy of said notice and statement upon the Secretary. Unless a later date is specified by the Secretary as part of his decision, the decision complained of shall be considered to be effective as of the date on which public announcement of the decision is made at the office of the Secretary in the city of Washington. The Secretary shall thereupon, and in any event not later than ten days from the date of such service upon him, mail or otherwise deliver a copy of said notice of appeal to each person shown by the records of the Secretary to be interested in such appeal and to have a right to intervene therein under the provisions of this section, and shall at all times thereafter permit any such person to inspect and make copies of appellants' reasons for said appeal at the office of the Secretary in the city of Washington. Within thirty days after the filing of said appeal the Secretary shall file with the court the originals or certified copies of all papers and evidence presented to him upon the hearing involved and also a like copy of his decision thereon and shall within thirty days thereafter file a full statement in writing of the facts and grounds for his decision as found and given by him and a list of all interested persons to whom he has mailed or otherwise delivered a copy of said notice of appeal.

(d) Within thirty days after the filing of said appeal any interested person may intervene and participate in the proceedings had upon said appeal by filing with the court a notice of intention to intervene and a verified statement showing the nature of the interest of such party, together with proof of service of true copies of said notice and statement, both upon the appellant and upon the Secretary. Any person who would be aggrieved or whose interests would be adversely affected by reversal or modification of the decision of the Secretary complained of shall be considered an interested party.

(e) At the earliest convenient time the court shall hear and determine the appeal upon the record before it, and shall have power, upon such record, to enter a judgment affirming or reversing the decision, and if it enters an order reversing the decision of the Secretary it shall remand the case to the Secretary to carry

out the judgment of the court: *Provided, however*, That the review by the court shall be limited to questions of law and that findings of fact by the Secretary, if supported by substantial evidence, shall be conclusive unless it shall clearly appear that the findings of the Secretary are arbitrary or capricious. The court's judgment shall be final, subject, however, to review by the Supreme Court of the United States, upon writ of certiorari on petition therefor, under section 240 of the Judicial Code, as amended (U. S. C., 1934 ed., title 28, sec. 347), by appellant, by the Secretary, or by any interested party intervening in the appeal.

(f) The court may, in its discretion, enter judgment for costs in favor of or against an appellant, and other interested parties intervening in said appeal, but not against the Secretary, depending upon the nature of the issues involved in such appeal and the outcome thereof.

(g) The Government of the Commonwealth of the Philippine Islands shall make allotments of any quota established for it pursuant to the provisions of this Act on the basis specified in section 6 (d) of Public Law Numbered 127, approved March 24, 1934.

SEC. 206. Until sugar quotas are established pursuant to this Act for the calendar year 1937, which shall be within sixty days after its enactment, the quotas determined by the Secretary in General Sugar Quota Regulations, Series 4, Number 1, issued December 12, 1936, pursuant to the provisions of the Agricultural Adjustment Act, as amended, shall remain in full force and effect.

SEC. 207. (a) Not more than twenty-nine thousand six hundred and sixteen short tons, raw value, of the quota for Hawaii for each of the calendar years 1937, 1938, and 1939 may be filled by direct-consumption sugar; and not more than four thousand nine hundred and thirty-six short tons, raw value, of the quota for Hawaii for the calendar year 1940 may be filled, during the first two months of such year, by direct-consumption sugar.

(b) Not more than one hundred and twenty-six thousand and thirty-three short tons, raw value, of the quota for Puerto Rico for each of the calendar years 1937, 1938, and 1939 may be filled by direct-consumption sugar; and not more than twenty-one thousand and six short tons, raw value, of the quota for Puerto Rico for the calendar year 1940 may be filled, during the first two months of such year, by direct-consumption sugar.

(c) None of the quota for the Virgin Islands for any calendar year may be filled by direct-consumption sugar.

(d) Not more than eighty thousand two hundred and fourteen short tons, raw value, of the quota for the Commonwealth of the Philippine Islands for any calendar year may be filled by direct-consumption sugar.

(e) Not more than three hundred and seventy-five thousand short tons, raw value, of the quota for Cuba for any calendar year may be filled by direct-consumption sugar.

(f) This section shall not apply with respect to the quotas established under section 203 for marketing for local consumption in Hawaii and Puerto Rico.

SEC. 208. Quotas for liquid sugar for foreign countries for each calendar year are hereby established as follows:

Country:	*In terms of wine gallons of 72% total sugar content*
Cuba	7,970,558
Dominican Republic	830,894
Other foreign countries	0

The quantities of liquid sugar imported into the continental United States during the calendar year 1937, prior to the enactment of this Act, shall be charged against the quotas for the calendar year 1937 established by this section.

SEC. 209. All persons are hereby prohibited—

(a) From bringing or importing into the continental United States from the Territory of Hawaii, Puerto Rico, the Virgin Islands, the Commonwealth of the Philippine Islands, or foreign countries, any sugar or liquid sugar after the quota for such area, or the proration of any such quota, has been filled;

(b) From shipping, transporting, or marketing in interstate commerce, or in competition with sugar or liquid sugar shipped, transported, or marketed in interstate or foreign commerce, any sugar or liquid sugar produced from sugar beets or sugarcane grown in either the domestic-beet-sugar area or the mainland-cane-sugar area after the quota for such area has been filled;

(c) From marketing in either the Territory of Hawaii or Puerto Rico, for consumption therein, any sugar or liquid sugar after the quota therefor has been filled;

(d) From exceeding allotments of any quota or proration thereof made to them pursuant to the provisions of this Act.

SEC. 210. (a) The determinations provided for in sections 201 and 203, and all quotas, prorations, and allotments, except quotas established pursuant to the provisions of section 208, shall be made or established in terms of raw value.

(b) For the purposes of this title, liquid sugar, except that imported from foreign countries, shall be included with sugar in making the determinations provided for in sections 201 and 203 and in the establishment or revision of quotas, prorations, and allotments.

SEC. 211. (a) The raw-value equivalent of any sugar or liquid sugar in any form, including sugar or liquid sugar in manufactured products, exported from the continental United States under the provisions of section 313 of the Tariff Act of 1930 shall be credited against any charges which shall have been made in respect to the applicable quota or proration for the country of origin. The country of origin of sugar or liquid sugar in respect to which any credit shall be established shall be that country in respect to importation from which drawback of the exported sugar or liquid sugar has been claimed. Sugar or liquid sugar entered into the continental United States under an applicable bond established pursuant to orders or regulations issued by the Secretary, for the express purpose of subsequently exporting the equivalent quantity of sugar or liquid sugar as such, or in manufactured articles, shall not be charged against the applicable quota or proration for the country of origin.

(b) Exportation within the meaning of sections 309 and 313 of the Tariff Act of 1930 shall be considered to be exportation within the meaning of this section.

(c) The quota established for any domestic sugar producing area may be filled only with sugar or liquid sugar produced from sugar beets or sugarcane grown in such area: *Provided, however*, That any sugar or liquid sugar admitted free of duty from the Virgin Islands under the Act of Congress, approved March 3, 1917 (39 Stat. 1133), may be admitted within the quota for the Virgin Islands.

SEC. 212. The provisions of this title shall not apply to (1) the first ten short tons, raw value, of sugar or liquid sugar imported from any foreign country, other than Cuba, in any calendar year; (2) the first ten short tons, raw value, of sugar or liquid sugar imported from any foreign country, other than Cuba, in any calendar year for religious, sacramental, educational, or experimental purposes; (3) liquid sugar imported from any foreign country, other than Cuba, in individual sealed containers of such capacity as the Secretary may determine, not in excess of one and one-tenth gallons each; or (4) any sugar or liquid sugar imported, brought into, or produced or manufactured in the United States for the distillation of alcohol, or for livestock feed, or for the production of livestock feed.

TITLE III—CONDITIONAL-PAYMENT PROVISIONS

SEC. 301. The Secretary is authorized to make payments on the following conditions with respect to sugar or liquid sugar commercially recoverable from the sugar beets or sugarcane grown on a farm for the extraction of sugar or liquid sugar:

(a) That no child under the age of fourteen years shall have been employed or permitted to work on the farm, whether for gain to such child or any other person, in the production, cultivation, or harvesting of a crop of sugar beets or sugarcane with respect to which application for payment is made, except a member of the immediate family of a person who was the legal owner of not less than 40 per centum of the crop at the time such work was performed; and that no child between the ages of fourteen and sixteen years shall have been employed or permitted to do such work, whether for gain to such child or any other person, for a longer period than eight hours in any one day, except a member of the immediate family of a person who was the legal owner of not less than 40 per centum of the crop at the time such work was performed.

(b) That all persons employed on the farm in the production, cultivation, or harvesting of sugar beets or sugarcane with respect to which an application for payment is made shall have been paid in full for all such work, and shall have been paid wages therefor at rates not less than those that may be determined by the Secretary to be fair and reasonable after investigation and due notice and opportunity for public hearing; and in making such determinations the Secretary shall take into consideration the standards therefor formerly established by him under the Agricultural Adjustment Act, as amended, and the

differences in conditions among various producing areas: *Provided, however,* That a payment which would be payable except for the foregoing provisions of this subsection may be made, as the Secretary may determine, in such manner that the laborer will receive an amount, insofar as such payment will suffice, equal to the amount of the accrued unpaid wages for such work, and that the producer will receive the remainder, if any, of such payment.

(c) That there shall not have been marketed (or processed) an amount (in terms of planted acreage, weight, or recoverable sugar content) of sugar beets or sugarcane grown on the farm and used for the production of sugar or liquid sugar to be marketed in, or so as to compete with or otherwise directly affect interstate or foreign commerce, in excess of the proportionate share for the farm, as determined by the Secretary pursuant to the provisions of section 302, of the total quantity of sugar beets or sugar cane required to be processed to enable the area in which such sugar beets or sugarcane are produced to meet the quota (and provide a normal carry-over inventory) as estimated by the Secretary for such area for the calendar year during which the larger part of the sugar or liquid sugar from such crop normally would be marketed.

(d) That the producer on the farm who is also, directly or indirectly, a processor of sugar beets or sugarcane, as may be determined by the Secretary, shall have paid, or contracted to pay under either purchase or toll agreements, for any sugar beets or sugarcane grown by other producers and processed by him at rates not less than those that may be determined by the Secretary to be fair and reasonable after investigation and due notice and opportunity for public hearing.

(e) That there shall have been carried out on the farm such farming practices in connection with the production of sugar beets and sugarcane during the year in which the crop was harvested with respect to which a payment is applied for, as the Secretary may determine, pursuant to this subsection, for preserving and improving fertility of the soil and for preventing soil erosion, such practices to be consistent with the reasonable standards of the farming community in which the farm is situated.

The conditions provided in subsection (a) and in subsection (b) with respect to wage rates, of this section shall not apply to work performed prior to the enactment of this Act; and the condition provided in subsection (c) of this section shall not apply to the marketing of the first crop harvested after the enactment of this Act from sugar beets or sugar cane planted prior to such enactment.

SEC. 302. (a) The amount of sugar or liquid sugar with respect to which payment may be made shall be the amount of sugar or liquid sugar commercially recoverable, as determined by the Secretary, from the sugar beets or sugarcane grown on the farm and marketed (or processed by the producer) not in excess of the proportionate share for the farm, as determined by the Secretary, of the quantity of sugar beets or sugarcane for the extraction of sugar or liquid sugar required to be processed to enable the producing area in which the crop of sugar beets or sugarcane is grown to meet the quota (and provide a normal carry-over inventory) estimated by the Secretary for such area for the calendar year during which the larger part of the sugar or liquid sugar from such crop normally would be marketed.

(b) In determining the proportionate shares with respect to a farm, the Secretary may take into consideration the past production on the farm of sugar beets and sugarcane marketed (or processed) for the extraction of sugar or liquid sugar and the ability to produce such sugar beets or sugarcane, and the Secretary shall, insofar as practicable, protect the interests of new producers and small producers and the interests of producers who are cash tenants, share-tenants, adherent planters, or share-croppers.

(c) Payments shall be effective with respect to sugar or liquid sugar commercially recoverable from sugar beets and sugarcane grown on a farm and which shall have been marketed (or processed by the producer) on and after July 1, 1937.

SEC. 303. In addition to the amount of sugar or liquid sugar with respect to which payments are authorized under subsection (a) of section 302, the Secretary is also authorized to make payments, on the conditions provided in section 301, with respect to bona-fide abandonment of planted acreage and crop deficiencies of harvested acreage, resulting from drought, flood, storm, freeze, disease, or insects, which cause such damage to all or a substantial part of

the crop of sugar beets or sugarcane in the same factory district (as established by the Secretary), county, parish, municipality, or local producing area, as determined in accordance with regulations issued by the Secretary, on the following quantities of sugar or liquid sugar: (1) With respect to such bona-fide abandonment of each planted acre of sugar beets or sugarcane, one-third of the normal yield of commercially recoverable sugar or liquid sugar per acre for the farm, as determined by the Secretary; and (2) with respect to such crop deficiencies of harvested acreage of sugar beets or sugarcane, the excess of 80 per centum of the normal yield of commercially recoverable sugar or liquid sugar for such acreage for the farm, as determined by the Secretary, over the actual yield.

SEC. 304. (a) The amount of the base rate of payment shall be 60 cents per hundred pounds of sugar or liquid sugar, raw value.

(b) All payments shall be calculated with respect to a farm which, for the purposes of this Act, shall be a farming unit as determined in accordance with regulations issued by the Secretary, and in making such determinations, the Secretary shall take into consideration the use of common work stock, equipment, labor, management, and other pertinent factors.

(c) The total payment with respect to a farm shall be the product of the base rate specified in subsection (a) of this section multiplied by the amount of sugar and liquid sugar, raw value, with respect to which payment is to be made, except that reductions shall be made from such total payment in accordance with the following scale of reductions:

That portion of the quantity of sugar and liquid sugar which is included within the following intervals of short tons, raw value:	*Reduction in the base rate of payment per hundredweight of such portion*
500 to 1,500	$0.050
1,500 to 6,000	.075
6,000 to 12,000	1.00
12,000 to 30,000	.125
More than 30,000	.300

(d) Application for payment shall be made by, and payments shall be made to, the producer or, in the event of his death, disappearance, or incompetency, his legal representative, or heirs: *Provided, however*, That all producers on the farm shall signify in the application for payment the per centum of the total payment with respect to the farm to be made to each producer: *And provided further*, That payments may be made, (1) in the event of the death, disappearance, or incompetency of a producer, to such beneficiary as the producer may designate in the application for payment; (2) to one producer of a group of two or more producers, provided all producers on the farm designate such producer in the application for payment as sole recipient for their benefit of the payment with respect to the farm; or (3) to a person who is not a producer, provided such person controls the land included within the farm with respect to which the application for payment is made and is designated by the sole producer (or all producers) on the farm, as sole recipient for his or their benefit, of the payment with respect to the farm.

SEC. 305. In carrying out the provisions of title II and III of this Act, the Secretary is authorized to utilize local committees of sugar beet or sugarcane producers, State and county agricultural conservation committees, or the Agricultural Extension Service and other agencies, and the Secretary may prescribe that all or a part of the expenses of such committees may be deducted from the payments herein authorized.

SEC. 306. The facts constituting the basis for any payment, or the amount thereof authorized to be made under this title, officially determined in conformity with rules or regulations prescribed by the Secretary, shall be reviewable only by the Secretary, and his determinations with respect thereto shall be final and conclusive.

SEC. 307. This title shall apply to the continental United States, the Territory of Hawaii, and Puerto Rico.

TITLE IV—EXCISE TAXES WITH RESPECT TO SUGAR

DEFINITIONS

SEC. 401. For the purposes of this title—

(a) The term "person" means an individual, partnership, corporation, or association.

(b) The term "manufactured sugar" means any sugar derived from sugar beets or sugarcane, which is not to be, and which shall not be, further refined or otherwise improved in quality; except sugar in liquid form which contains nonsugar solids (excluding any foreign substance that may have been added) equal to more than 6 per centum of the total soluble solids, and except also sirup of cane juice produced from sugarcane grown in continental United States.

The grades or types of sugar within the meaning of this definition shall include, but shall not be limited to, granulated sugar, lump sugar, cube sugar, powdered sugar, sugar in the form of blocks, cones, or molded shapes, confectioners' sugar, washed sugar, centrifugal sugar, clarified sugar, turbinado sugar, plantation white sugar, muscovado sugar, refiners' soft sugar, invert sugar mush, raw sugar, sirups, molasses, and sugar mixtures.

(c) The term "total sugars" means the total amount of the sucrose (Clerget) and of the reducing or invert sugars. The total sugars contained in any grade or type of manufactured sugar shall be ascertained in the manner prescribed in paragraphs 758, 759, 762, and 763 of the United States Customs Regulations (1931 edition).

(d) The term "United States" shall be deemed to include the States, the Territories of Hawaii and Alaska, the District of Columbia, and Puerto Rico.

TAX ON THE MANUFACTURE OF SUGAR

SEC. 402. (a) Upon manufactured sugar manufactured in the United States, there shall be levied, collected, and paid a tax, to be paid by the manufacturer at the following rates:

(1) On all manufactured sugar testing by the polariscope ninety-two sugar degrees, 0.465 cent per pound, and for each additional sugar degree shown by the polariscopic test, 0.00875 cent per pound additional, and fractions of a degree in proportion;

(2) On all manufactured sugar testing by the polariscope less than ninety-two sugar degrees, 0.5144 cent per pound of the total sugars therein.

(b) Any person who acquires any sugar which is to be manufactured into manufactured sugar but who, without further refining or otherwise improving it in quality, sells such sugar as manufactured sugar or uses such sugar as manufactured sugar in the production of other articles for sale shall be considered for the purposes of this section the manufacturer of manufactured sugar and, as such, liable for the tax hereunder with respect thereto.

(c) The manufacturer shall file on the last day of each month a return and pay the tax with respect to manufactured sugar manufactured after the effective date of this title (1) which has been sold, or used in the production of other articles, by the manufacturer during the preceding month (if the tax has not already been paid) and (2) which has not been so sold or used within twelve months ending during the preceding calendar month, after it was manufactured (if the tax has not already been paid): *Provided*, That the first return and payment of the tax shall not be due until the last day of the second month following the month in which this title takes effect.

For the purpose of determining whether sugar has been sold or used within twelve months after it was manufactured sugar shall be considered to have been sold or used in the order in which it was manufactured.

(d) No tax shall be required to be paid upon the manufacture of manufactured sugar by, or for, the producer of the sugar beets or sugarcane from which such manufactured sugar was derived, for consumption by the producer's own family, employees, or household.

IMPORT COMPENSATING TAX

SEC. 403. (a) In addition to any other tax or duty imposed by law, there shall be imposed, under such regulations as the Commissioner of Customs shall pre-

scribe, with the approval of the Secretary of the Treasury, a tax upon articles imported or brought into the United States as follows:

(1) On all manufactured sugar testing by the polariscope ninety-two sugar degrees, 0.465 cent per pound, and for each additional sugar degree shown by the polariscopic test, 0.00875 cent per pound additional, and fractions of a degree in proportion;

(2) On all manufactured sugar testing by the polariscope less than ninety-two sugar degrees, 0.5144 cent per pound of the total sugars therein;

(3) On all articles composed in chief value of manufactured sugar, 0.5144 cent per pound of the total sugars therein.

(b) Such tax shall be levied, assessed, collected, and paid in the same manner as a duty imposed by the Tariff Act of 1930, and shall be treated for the purposes of all provisions of law relating to the customs revenue as a duty imposed by such Act, except that for the purposes of sections 336 and 350 of such Act (the so-called flexible-tariff and trade-agreements provisions) such tax shall not be considered a duty or import restriction, and except that no preference with respect to such tax shall be accorded any articles imported or brought into the United States.

EXPORTATION, LIVESTOCK FEED, AND DISTILLATION

SEC. 404. (a) Upon the exportation from the United States to a foreign country, or the shipment from the United States to any possession of the United States except Puerto Rico, of any manufactured sugar, or any article manufactured wholly or partly from manufactured sugar, with respect to which tax under the provisions of section 402 has been paid, the amount of such tax shall be paid by the Commissioner of Internal Revenue to the consignor named in the bill of lading under which the article was exported or shipped to a possession, or to the shipper, if the consignor waives any claim thereto in favor of such shipper: *Provided*, That no such payment shall be allowed with respect to any manufactured sugar, or article, upon which, through substitution or otherwise, a drawback of any tax paid under section 403 has been or is to be claimed under any provisions of law made applicable by section 403.

(b) Upon the use of any manufactured sugar, or article manufactured therefrom, as livestock feed, or in the production of livestock feed, or for the distillation of alcohol, there shall be paid by the Commissioner of Internal Revenue to the person so using such manufactured sugar, or article manufactured therefrom, the amount of any tax paid under section 402 with respect thereto.

(c) No payment shall be allowed under this section unless within one year after the right to such payment has accrued a claim therefor is filed by the person entitled thereto.

COLLECTION OF TAXES

SEC. 405. (a) Except as otherwise provided, the taxes imposed by this title shall be collected by the Bureau of Internal Revenue under the direction of the Secretary of the Treasury. Such taxes shall be paid into the Treasury of the United States.

(b) All provisions of law, including penalties, applicable with respect to the taxes imposed under title IV of the Revenue Act of 1932, shall, insofar as applicable and not inconsistent with the provisions of this title, be applicable in respect to the tax imposed by section 402. If the tax is not paid when due, there shall be added as part of the tax interest at 6 per centum per annum from the date the tax became due until the date of payment.

(c) The Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe such rules and regulations as may be necessary to carry out all provisions of this title except section 403.

(d) Any person required, pursuant to the provisions of section 402, to file a return may be required to file such return with and pay the tax shown to be due thereon to the collector of internal revenue for the district in which the manufacturing was done or the liability incurred.

EFFECTIVE DATE

SEC. 406. The provisions of this title shall become effective on the date of enactment of this Act.

TITLE V—GENERAL PROVISIONS

SEC. 501. For the purposes of this Act, except title IV, the Secretary shall—

(a) Appoint and fix the compensation of such officers and employees as he may deem necessary in administering the provisions of this Act: *Provided*, That all such officers and employees, except attorneys, economists, experts, and persons in the employ of the Department of Agriculture on the date of the enactment of this Act, shall be subject to the provisions of the civil-service laws and the Classification Act of 1923, as amended: *And provided further*, That no salary in excess of $10,000 per annum shall be paid to any such person.

(b) Make such expenditures as he deems necessary to carry out the provisions of this Act, including personal services and rents in the District of Columbia and elsewhere, traveling expenses (including the purchase, maintenance, and repair of passenger-carrying vehicles), supplies and equipment, law books, books of reference, directories, periodicals, and newspapers.

SEC. 502. (a) There is hereby authorized to be appropriated for each fiscal year for the purposes and administration of this Act, except for allotments in the Philippine Islands as provided in subsection (g) of section 205, a sum not to exceed $55,000,000.

(b) All funds available for carrying out this Act shall be available for allotment to the bureaus and offices of the Department of Agriculture and for transfer to such other agencies of the Federal Government as the Secretary may request to cooperate or assist in carrying out the provisions of this Act.

SEC. 503. There is authorized to be appropriated an amount equal to the amount of the taxes collected or accrued under title IV on sugars produced from sugarcane grown in the Commonwealth of the Philippine Islands which are manufactured in or brought into the United States on or prior to June 30, 1941, minus the costs of collecting such taxes and the estimates of amounts of refunds required to be made with respect to such taxes, for transfer to the Government of the Commonwealth of the Philippines for the purpose of financing a program of economic adjustment in the Philippines, the transfer to be made under such terms and conditions as the President of the United States may prescribe: *Provided*, That no part of the appropriations herein authorized shall be paid directly or indirectly for the production or processing of sugarcane in the Philippine Islands.

SEC. 504. The Secretary is authorized to make such orders or regulations, which shall have the force and effect of law, as may be necessary to carry out the powers vested in him by this Act. Any person knowingly violating any order or regulation of the Secretary issued pursuant to this Act shall, upon conviction, be punished by a fine of not more than $100 for each such violation.

SEC. 505. The several district courts of the United States are hereby vested with jurisdiction specifically to enforce, and to prevent and restrain any person from violating the provisions of this Act or of any order or regulation made or issued pursuant to this Act. If and when the Secretary shall so request, it shall be the duty of the several district attorneys of the United States, in their respective districts, to institute proceedings to enforce the remedies and to collect the penalties and forfeitures provided for in this Act. The remedies provided for in this Act shall be in addition to, and not exclusive of, any of the remedies or penalties existing at law or in equity.

SEC. 506. Any person who knowingly violates, or attempts to violate, or who knowingly participates or aids in the violation of, any of the provisions of section 209, or any person who brings or imports into the continental United States direct-consumption sugar after the quantities specified in section 207 have been filled, shall forfeit to the United States the sum equal to three times the market value, at the time of the commission of any such, (a) of that quantity of sugar or liquid sugar by which any quota, proration, or allotment is exceeded, or (b) of that quantity brought or imported into the continental United States after the quantities specified in section 207 have been filled, which forfeiture shall be recoverable in a civil suit brought in the name of the United States.

SEC. 507. All persons engaged in the manufacturing, marketing, or transportation of sugar or liquid sugar, and having information which the Secretary deems necessary to enable him to administer the provisions of this Act, shall, upon

the request of the Secretary, furnish him with such information. Any person willfully failing or refusing to furnish such information, or furnishing willfully any false information, shall upon conviction be subject to a penalty of not more than $1,000 for each such violation.

SEC. 508. No person shall, while acting in any official capacity in the administration of this Act, invest or speculate in sugar or liquid sugar, contracts relating thereto, or the stock or membership interests of any association or corporation engaged in the production or manufacturing of sugar or liquid sugar. Any person violating this section shall upon conviction thereof be fined not more than $10,000 or imprisoned not more than two years, or both.

SEC. 509. Whenever the President finds and proclaims that a national economic or other emergency exists with respect to sugar or liquid sugar, he shall by proclamation suspend the operation of title II or III above, which he determines, on the basis of such findings, should be suspended, and, thereafter, the operation of any such title shall continue in suspense until the President finds and proclaims that the facts which occasioned such suspension no longer exist. The Secretary shall make such investigations and reports thereon to the President as may be necessary to aid him in carrying out the provisions of this section.

SEC. 510. The provisions of the Agricultural Adjustment Act, as amended, shall cease to apply to sugar upon the enactment of this Act, and the provisions of Public Resolution Numbered 109, Seventy-fourth Congress, approved June 19, 1936, are hereby repealed.

SEC. 511. In order to facilitate the effectuation of the purposes of this Act, the Secretary is authorized to make surveys, investigations, including the holding of public hearings, and to make recommendations with respect to (a) the terms and conditions of contracts between the producers and processors of sugar beets and sugarcane and (b) the terms and conditions of contracts between laborers and producers of sugar beets and sugarcane.

SEC. 512. The Secretary is authorized to conduct surveys, investigations, and research relating to the conditions and factors affecting the methods of accomplishing most effectively the purposes of this Act and for the benefit of agriculture generally in any area. Notwithstanding any provision of existing law, the Secretary is authorized to make public such information as he deems necessary to carry out the provisions of this Act.

SEC. 513. No tax shall be imposed on the manufacture, use, or importation of sugar after June 30, 1941, and the powers vested in the Secretary under this Act shall terminate on December 31, 1940, except that the Secretary shall have power to make payments under title III under programs applicable to the crop year 1940 and previous crop years.

Approved, September 1, 1937.

INDEX

Page

Adjustment—
policy, objectives 123–137
program—
1933, modification by drought conditions 125–126
1936, comparison with earlier ones 32–33
1937, changes 34–35
1937, summary 49–51
acceptance by farmers 212–213
administration, progress 209–246
appraisal, value 156
background 1–9, 237
development of plans 211–212
effects on prices and income 139–156
interruption by emergencies, 1929 128–129
legislative summary 11–21
local operation 222–226
necessity for 1–2, 5–9
objectives 133–137
problems 209, 213
programs—
accomplishments 162–169
administration 23–122
aid to recovery, discussion 247–249
analyses, conditions and limitations 141–143
appropriation acts 20–21
evaluations, comparison 139–141
success, factors affecting 238–241
supplemental features 27–30
Agricultural—
assistance, early measures 4–5
conservation, aid by programs 248–249
legislation, need 98
policy—
evolutionary nature 21
major objectives 213–214
problems, regional studies 218, 219
products, export and diversion programs, effectiveness 95–97
Agricultural Adjustment Act—
amendments, summary 11–15
of 1933—
aid to recovery, discussion 247–249
objectives, emergency factors 123–125
of 1938—
aid to milk cooperatives 206
authorization of commodity loans 119–122
local administration 122
objectives 102–103, 131–133, 221
program 97–122
protection to small and tenant farmers 106
provisions 17–20, 97–122, 211, 214
referendum provisions 104
writing and problems involved 101–102
Agricultural Adjustment Administration—
early program and objectives 127–129
establishment and purpose 136–137
functions 214–216
immediate duties 211–213, 244
informational policies 226–243
local operation, progress 222–226
long-time tasks 213–218, 244–246
marketing programs 173–208
national and local cooperation 221–222
organization 210–211
programs 23–122

Page

Agricultural Adjustment Administration—Continued.
progress 243–246
soil conservation and farming objectives 157–171
Agricultural Conservation Program—
formulation and legislation 100–101
See also Conservation program.
Agricultural Marketing Act—
aid to milk cooperatives 206
of 1929, provisions 124
Agricultural Marketing Agreement Act of 1937, provisions and accomplishments 72–79
Agriculture—
disadvantages, sources 2–4
Secretary of—
duties under Public, No. 320, section 32 90
duties under Sugar Act 61
regulation of fluid-milk markets 76
Apples, marketing agreements and price-fixing regulations 197–198
Appropriation acts for adjustment programs, description 20–21
Asparagus, canned, marketing agreement 193

Bang's disease, eradication 79–82
Bankhead Cotton Act, summary 12
Benefit payments—
average per farmer in various States 49
conditional, provisions 59–60
protection to tenant farmers 106
provisions and financing 11–12
rates 47–49
rates and time 25–26
to drought-stricken farmers 126
to range operators, rates 52–53
to sugar producers 56–57
types 44–47

California Fig Institute, diversion program 94
California Fresh Deciduous Tree Fruit Marketing Agreement, regulations governing Bartlett pears 190
California Pear League, diversion program 93
Campaigns, political, participation by farmers, prohibition 242–243
Capper-Volstead Act, aid to milk cooperatives 206–207
Cattle—
purchase program, analysis 146–147
purchases by Government 126
testing for Bang's disease, expenditures, 1934–38 81–82
tuberculin testing, expenditures, 1934–38 80–81
Child-labor provisions, Sugar Act of 1937 57–58
Citrus fruits—
marketing agreements and volume regulation 190, 192, 194
purchase program, recommended 179
Coffee diversion program, factors involved 183
Colleges, State agricultural, cooperation in experimental county conservation programs 67

Commodities— Page
consumption, stimulating by marketing programs 178–179
grades and sizes, regulation 192–196
irregularity of production 2–3
marketing—
movement regulation 190
objectives 133–134
outlet regulation 189
period regulation 189–190
quantity regulation 188–189
minimum prices and price posting agreements 196–200
type and volume regulations affecting 186–192
Commodity—
adjustment programs, 1933–35 23–30
loans—
effect on farm prices 28–29
to farmers, conditions 118–122
programs—
analysis of effects on prices and incomes 141–142
operation 223–224
Commodity Credit Corporation, loans to farmers 118–122
Conservation—
problem, need for group action 158–160
program—
acreage diverted and soil-building practices 164, 165
background and phases 237
effect on farm efficiency 168–169
effect on soil-conserving practices 166–167
flexibility problem 170–171
formulation and administration 219–221
in 1936 30–33
in 1937 33–51
in 1938, report 97–122
local operation 222–226
objectives 51
problems 213
result of change from wasteful land practices 157–160
unsolved problems 169–171
variations in regional needs 160–162
work of Consumers' Counsel Division 61
programs, county, experimental 67–70
Consumer preferences, studies 62
Consumers—
cooperatives, work and membership 63
effects of purchasing programs 177–178, 179–180
Consumers' Counsel Division, activities 61–67
Consumers' Guide, services 62, 63–64
Consumption, domestic, encouragement through relief purchases 173–181
Corn—
acreage—
allotments, apportionment 104–105
allotments, distribution 113–114
limits for soil conservation 39
growers, application of Agricultural Adjustment Act of 1938 113–114
loans, by Commodity Credit Corporation, conditions 121
marketing quotas, description 114
parity payments 105–106
producers, income increases, 1933–36 144–146
production adjustment program, analysis 143–147
Corn-hog production adjustment program, analysis 144–146
Cotton—
acreage—
allotments, apportionment 105
reduction under conservation programs 69
growers—
application of Agricultural Adjustment Act of 1938 108–111
income increases, 1933–38 150
Cotton—Continued. Page
loans by Commodity Credit Corporation, conditions 121–122
marketing quotas, description 109–111
parity payments 105–106
price-adjustment payments, provisions for 106
production adjustment program, analysis 148–152
referendum, results 110–111
seed, income increases, 1933–38 152
surplus, diversion program 92
Cottonseed, income increases, 1933–38 150, 151
County planning committees—
organization and expansion possibilities 219–221
work and organization 223–226
County Planning Project, inauguration and purpose 219–221
Credit, farm, measures affecting 5–6
Crop—
acreage—
bases, conservation problem 169–170
bases for land use 38–39
by regions, 1928–37 163
diverted and soil-building practices 164, 165
diversion plans, description and effects 181–186
insurance on wheat, provisions 116–117
yields, increase as conservation problem 170
Cropping systems, studies by county planning committees 219–221
Crops—
classification 37–38
general, marketing agreement programs 186–200
intertilled row, acreage limit 39
soil-conserving—
acreage, 1938 107
acreage bases 38–39
acreage goals 43–44
acreage increases, payments for 45
acreage seeded, 1937 50–51
county programs 68–70
increase by conservation program 166–167
list 38
soil-depleting—
acreage bases 38
acreage diversion 35–37
acreage goals 40–43
acreage reduction, 1937 50
allotments and benefit payments 107
effect of downward adjustment 162–165
list 37–38
volume regulation, provisions for 186–192
yield per acre, 1928–37 168

Dairy—
industry—
marketing programs 74–79, 200–208
price fixation 75, 78, 79
products—
manufactured, marketing agreements and licenses under Agricultural Marketing Agreement Act of 1937 77–79
marketing under Agricultural Marketing Agreement Act of 1937 72–73, 74–79
Dates, California, marketing agreements 190, 197
Democracy, function of information in, discussion 241–243
Depression, economic, emergency factors in adjustment program 123–125
DeRouen Rice Act, summary 13
Dollar, consumers', farmers' share for food 66–67
Domestic allotment plan—
benefits to farmers 127–128
provisions 8

Page
Drought, effect on agricultural adjustment program of 1933 125–126
Dry skim-milk marketing agreement 78

Education, agricultural, facilities 5
Emergency Appropriation Act, summary 13
Emergency relief—
purchases of surplus commodities 173–181
to farmers, objectives 123–125
Equalization-fee plan, proposals 7
Evaporated-milk, marketing agreement 78–79
Ever-Normal-Granary plan—
description 17–18
loans under Farm Act 118–122
objectives 131–133, 135
protection to farmers 249
provisions 74, 97, 103–104
Experiment stations, State, cooperation with Department in emergency programs 126–127
Experimental counties, development 221
Export-debenture plan, provisions 8
Export programs, description and effects 181–186
Extension Service—
administration of adjustment program 224–226
informational work among farmers 234–236

Farm—
acreage, allotments 104–105
cooperatives, objectives 6–7
crops, surplus—
application of Agricultural Adjustment Act of 1938 108–118
See also Surpluses.
data, local, methods of assembling 218, 219
land, conservation, variation in regional needs 160–162
leaders, national conference, results of Hoosac Mills decision 98
products—
exports, decline 3
supplies and prices, studies 62
surplus, diversion proposals 61
surplus. *See also* Surpluses.
programs, democratic planning and operation 136–137
Farm and Home Hour, radio broadcast 230
Farm Credit Administration, aid to milk cooperatives 206
Farm Security Administration, cooperation with Agricultural Adjustment Administration 135
Farmers—
acceptance of programs 212–213, 238–239
informational services for 234–237, 238–243
participation in—
A. A. A. program, reasons for 216–218, 221
political campaigns, prohibition 242–243
protection against unfair trade practices 4
tenant, benefit payments 106
Farming—
adjustments in, local planning 218–222
efficiency—
accomplishments of Agricultural Adjustment Administration 157–171
effect of conservation program 168–169
efficient, relation to soil conservation 135–136
objectives 157–171
systems, permanent improvements through adjustment program 126–129
Farms, diversion and non-diversion, definition 39–40
Federal Farm Board, objectives and operation 8–9
Federal Surplus Commodities Corporation—
Page
expenditures by commodities, 1935–38 85–86
operations 83–89
Federal Surplus Relief Corporation. *See* Federal Surplus Commodities Corporation.
Fertilizer, applications in soil-conservation program 51
Figs, dried, diversion programs 93–94
Flax—
diversion programs, objectives 183–184
fiber, purchasing power, programs to reestablish 94–95
Florida Citrus Marketing Agreement and License 1934–35, marketing regulations 190
Flour, surplus, export programs 91–92
Food—
consumption in relation to income, study 62
costs, retail, farmers' share 66–67
farm value 67
prices—
farm and retail, margin between 66–67
retail, study 62
retail value 67
Fruits—
California, marketing agreements, effects 191, 197
marketing under Agricultural Marketing Agreement Act of 1937 72–74

General Crops Section—
crop grade and size regulation 193–196
crop volume regulation 186–192
Government, aid to agriculture, early objectives 4–5
Granary. *See* Ever-Normal-Granary.

Hawaii, sugar—
benefit payments 57
production, fertilizer standards 59
Hog producers, income increases, 1933–36 144–146
Hoosac Mills case, Supreme Court decision 14–15, 72, 76, 97, 98, 99

Income—
consumer, increase, 1937 65
farm—
1937, comparison with earlier years 50
adjustments 134–135
disparity with urban 1–2
effect of rising unemployment 99–100
protection 104–105
nonfarm, of persons living on farms, cooperative study 62
relation to food consumption, study 62
Information—
dissemination—
1922 to date 5
methods 239–241
function and safeguards in a democracy, discussion 241–243
Informational policy, development 226–243
Insurance, crop. *See* Crop insurance.

Jones-Connally Cattle Act—
appropriation of funds 83, 84
provisions and programs 79–82
summary 12
Jones-Costigan Sugar Act, summary 13

Kerr Tobacco Act, summary 12–13

Labor provisions of Sugar Act of 1937 57–58
Land—
misuse, effects on welfare of Nation 158
policy, change from waste to conservation 157–160
use, crop-acreage bases 38–39
use, diversion, payments for 44–45

Legislation— Page
interpretation, problem 211
preparation and provisions 100–101
recent, summary 11–21
Lime, applications in soil-conservation program 51
Lint, income increases, 1933–38 151, 152
Livestock, production adjustment program, analysis 143–147
Living costs in 1937 65
Loans, to farmers, for Ever-Normal-Granary plan 118–122

Marketing—
adjustment—
objectives 133–134
programs, types, description 173–208
agreement programs, description 75–79
agreements—
and licenses, purpose and provisions 70–71
effect on farm prices 29–30
grade and size regulations 192–196
licenses, and orders 70–82
volume regulations, types and effects 188–192
work of Consumers' Counsel Division 61
cooperative, progress 6–7
programs, description 173–208
Marketing Agreement Act of 1937—
aid to milk cooperatives 206
provisions affecting grade regulations 193
summary 16–17
Marketing Agreement and License for Shippers of Package Bees and Queens Produced in the United States, provision governing 187, 198
Markets, expansion, programs 82–97
McNary-Boileau amendment to Adjustment Act of 1938 19
McNary-Haugen bill, passage and veto 124
Milk—
control boards, cooperative programs 204
cooperatives, relationship to A. A. A. programs 206–208
dealers, relationships with A. A. A. marketing programs 204–205
evaporated. *See* Evaporated milk.
fluid—
agreements, licenses, and orders 75–77
markets, programs 200–208
interstate commerce, regulation 77
marketing through cooperatives 206–208
prices, regulation, objectives 200–203
producer-distributors, relationships with A. A. A. marketing agreements 205–206
sales to handlers, proration of receipts from 203–204
skim. *See* Dry skim milk.

National Farm Act. *See* Agricultural Adjustment Act of 1938.
National Industrial Recovery Act of 1933, amendment affecting information for farmers 236
Nebraska, range practices and benefit payments 53
New York Milk Control Board, cooperative program 204

Oklahoma range, practices and benefit payments 53
Orange diversion program, factors involved 183
Oregon-Washington-California Pear League, diversion program 93

Pacific Dried Fruit Products Association, diversion programs 94
Parity payments to farmers 105–106
Peaches, California cling, marketing agreements 193, 197
Peanut diversion program, factors involved 182–183
Pear diversion program, factors involved 183
Pears—
California Bartlett, marketing agreement regulations 190, 195
diversion programs 93
Pecan diversion program, factors involved 182–183
Pig-and-sow-marketing program, effects 28
Potato Act, summary 14
Press Service, information work 229–231
Price fixation—
dairy industry 75, 78, 79
Federal Surplus Commodities Corporation 88–89
measures used in marketing agreements 197–198
Prices—
farm and retail, study 62
industrial, inflexibility in comparison with agricultural 3–4
minimum, regulations under marketing agreements 196–200
of food, farm and retail, margin between 66–67
of sugar under Sugar Act of 1937 61
stabilization by Federal Farm Board 8–9
stabilization by purchase program 179–180
wholesale, of sugar, 1937–38 60
Processing taxes, financing program 26–27
Producer contracts, terms 23–25
Producers, effects of purchasing programs 174–175, 176–177, 179–180
Program Planning, Division of, work 218
Propaganda, dissemination 227, 232–234, 236–237
Prune diversion program, factors involved 181–182
Prunes, dried, marketing agreements 190, 191, 193–194
Puerto Rico—
sugar-crop wages 60
sugar producers, benefit payments 57
sugar production, fertilizer standards 59
Puerto Rico Sugar Order No. 5, provisions 59
Purchase programs, principles and effects 173–181
Purchasing power—
effect on growers 188
reestablishment, programs 94–95

Radio Service, informational work 229–231
Raisin growers, benefits from marketing agreements and licenses 191, 193
Range conservation practices and benefit payments 52–53
Range Conservation Program—
1936–37 166–167
1937 51–54
Regional Adjustment Project of 1935, work 218, 220
Research services, description 231–232
Rice—
acreage—
allotments, apportionment 104–105
allotments, distribution 117–118
and domestic consumption allotments, provisions 117–118
growers—
application of Agricultural Adjustment Act of 1938 117–118
payments to 45
marketing quotas, description 118
parity payment 105–106
Roosevelt, President—
announcement of farm policy 97
statement on sugar excise tax 56

Page

Schechter Poultry Corporation case, decision and effects 13–14
Sheep purchase program, analysis 146–147
Soil—
building—
payments, 1937 46–49
practices, conservation programs 164, 165
practices, county programs 68–70
programs and goals 107
conservation—
accomplishments of Agricultural Adjustment Administration 157–171
approach to agricultural problems 129–131
objectives 157–171
relation to efficient farming 135–136
conserving—
crops. *See* Crops, soil-conserving.
practices, conservation problem 170
depleting crops. *See* Crops, soil-depleting.
losses, evidence of need for adjustment program 2
resources, conservation, objectives 136
Soil Conservation and Domestic Allotment Act—
administration 211, 219
amendments 18–19, 97
continuance 103
objectives 221
passage and provisions 129–131, 248–249
payments to sugar growers 59
provision authorizing aid of Consumer's Counsel Division 61
summary 15–16
South Dakota, range practices and benefit payments 53
Sugar—
excise tax, rate 61
prices—
under Sugar Act of 1937 61
wholesale, 1937–38 60
producers, benefit payments, conditional 56–57, 59–60
production—
fertilizer standards and use 59
labor and wage provisions of Sugar Act of 1937 57–58
program—
results in 1938 60–61
under Sugar Act of 1937 54–61
quota administration 55–60
Sugar Act of 1937—
achievements 60–61
program 54–61
provisions authorizing aid of Consumer's Counsel Division 61
summary 16, 54–55
Sugar beets, marketing, proportionate shares 58–59
Sugarcane—
growers, payments to 45
marketing, proportionate shares 58–59
Surpluses—
accumulation, problem 98–99
diversion programs 61, 90–91, 92–94, 95–97
export programs 90–92, 95–97
purchase—
and diversion 70
as aid to producers 174–175, 176–177, 179–180
as supplement to other marketing programs 175, 176
for relief distribution 82–89, 173–181

Surpluses—Continued. Page
purchase—Continued.
place in agricultural policy 180–181
removal, programs 82–97
Tariff—
disadvantages to agriculture 3
for farmers, search for 7–8
Tax, sugar excise, rate 61
Taxes, processing, financing program 26–27
Texas range, practices and benefit payments 53
Tobacco—
acreage—
allotments, apportionment 104–105
goals, establishment 111–112
burley, production adjustment program, analysis 155
cigar filler and binder, adjustment program, analysis 156
dark air-cured and fire-cured, adjustment program, analysis 155–156
flue-cured, production adjustment program, analysis 154–155
growers—
application of Agricultural Adjustment Act of 1938 111–113
income increases, 1933–38 153
marketing quotas, description 112–113
parity payments 105–106
production adjustment program, analysis by types 152–156
value increase by types, 1933–37 154
Tolley, H. R., letter of transmittal III
Tree crops—
diversion problems 184–185
marketing agreement regulations 190
Tuberculosis, bovine, eradication 79–81

Unemployment, increase, effect on agriculture 99–100
United States Supreme Court, invalidation of production-control procedure 128

Vegetables—
Colorado, marketing agreements 194–195
marketing under Agricultural Marketing Agreement Act of 1937 72–74

Wages, provisions under Sugar Act of 1937 58, 60
Walnut diversion program, factors involved 182–183
Walnuts, marketing agreements 194
Watermelons, marketing agreements 190, 195
Weather, effect on adjustment programs 142
Wheat—
acreage allotments—
apportionment 104–105
by States 115–116
growers—
application of Agricultural Adjustment Act of 1938 115–117
income increases, 1933–37 148
insurance, benefits to wheat growers 104
insurance, provisions 116–117
loans, by Commodity Credit Corporation, conditions 120–121
marketing quotas, description 116
parity payments 105–106
production adjustment program, analysis 147–148
World War, effect on American agriculture 98

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Bureau of Agricultural Economics

1938

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REPORT OF THE CHIEF OF THE BUREAU OF AGRICULTURAL ECONOMICS, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF AGRICULTURAL ECONOMICS,
Washington, D. C., October 15, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I present herewith the report of the Bureau of Agricultural Economics for the fiscal year ended June 30, 1938.

Sincerely yours,

A. G. BLACK, *Chief.*

CONTENTS

	Page
Bountiful harvest	1
Mortgage debt	2
Commercial loans increased	3
The tax problem	3
Exports up, imports down	4
Foreign research	4
Agricultural surveys	5
Looking ahead	6
Crop insurance	7
Ten million submarginal acres	7
Land development	8
New uses for land	9
Cooperative land development	10
Water utilization	11
Flood control	11
Resettlement	11
Action programs	12
Rural life	12
Farm population	12
Farm tenancy	13
Farm labor	13
Farm management	14
Rehabilitation programs	15
Range problems	15
Type-of-farming research	16
Localized area studies	16
Commodity studies	16
Basic statistics	17
County estimates	17
Income parity	18
Statistics for use	19
Standardization and inspection	19
Grain standards	20
Market news	21
New cotton services	22
Cotton research	22
Ginning and spinning	23
New fabrics	23
Sampling cotton	24
Feed grains	24
The soybean industry	25
Verified seeds	25
Livestock and meats	26
Livestock auctions	26
Four national packers	27
Factors affecting supply	27
Direct marketing	27
Wool research	28
Dairy and poultry	28
Conflicting dairy laws	29
Fruits and vegetables	29
Price-making factors	30
Special marketing studies	30
Perishable Commodities Act	31
Tobacco inspection	31
Warehouse Act	32
Lower insurance rates	33
Marketing research	33
Terminal markets	34
Wholesale markets	35
Marketing costs	35

BOUNTIFUL HARVEST

Nineteen thirty-eight has been another year of bountiful harvests. The Nation's granaries are full to overflowing, the feed supply for the production of meat and other livestock products is about the

largest in 12 years; the supply of fibers for industrial manufacture is close upon the largest on record. For this the farmers will receive about a billion dollars less in cash farm income this year than last.

The Bureau estimates the 1938 cash farm income at more than $7,500,000,000. This may be compared with $8,600,000,000 in 1937, with $7,944,000,000 in 1936, and with $4,328,000.000 at the bottom of the economic depression in 1932. The decline in farm income this year follows 5 successive years in which farmers' cash income had increased over the preceding year.

The reduction in 1938 farm income is attributed largely to the marked decline in industrial activity during the past year and to the lower level of income of urban consumers. Prices of farm products were forced down to lowest figures in several years but corresponding reductions were not made in prices of commodities farmers buy. In late summer, the buying power of farm products was 75 percent of pre-war.

Prices of farm products began the sharp decline in the fall of 1937. But despite this decline, farmers in 1938 maintained their production plant at about 1937 levels, and close to the average of the preceding 10 years. While factory employment was cut 25 percent, farmers employed about the same number of workers and paid only slightly lower wages. There was a decrease in the area planted to cotton, but this reduction was more than offset by a large net increase in acreage of food and feed crops.

Other elements in the fiscal position of agriculture during the year included a slight decrease in farm-mortgage debt and an increase in farm taxes. Available information indicates that the costs of farm production decreased much less than the decline in farm income. (The Bureau is now working on statistical series dealing with annual expenditures by farmers for commodities and services used on the farm and in the farm home.) There was probably no gain in farm real estate values.

MORTGAGE DEBT

For several years the farm-mortgage debt has been declining, sharply from 1930–35 through liquidation of debt by foreclosures and related transfers, less sharply after 1935 when voluntary repayments increased. For the last date of record, January 1, 1938, the farm-mortgage debt stood at about $7,082,000,000. The 1938 figure represents a decrease of more than $2,000,000,000 since 1930 when the debt totaled about $9,200,000,000. The mortgage debt in 1935 was about $7,650,000,000. About 64 percent of the 1935 debt was on owner-operated farms. Presumably about the same proportion exists now.

A survey revealed that the Federal land banks and the Land Bank Commissioner held almost 40 percent of all farm-mortgage indebtedness at the beginning of 1937, as compared with about one-third of the total at the beginning of 1935 and only slightly more than one-eighth held by the Federal land banks in 1930. Life insurance companies in 1937 held less than one-half the volume of farm-mortgage loans held by them in 1930. The total for 1937 was 12.9 percent of all farm-mortgage debt as compared with 22.9 percent of the much larger total in 1930.

The Bureau continued its analysis of data from the Nation-wide Works Progress Administration survey of farm mortgages and farm transfers. Separate reports were released for 20 States showing the percentage distribution of newly recorded mortgages by lender groups annually, 1917–35, and the average interest rate and consideration on these mortgage loans. These State reports afford a detailed factual background for an analysis of mortgage-credit trends. Noteworthy is the reduction since 1930 in average interest rates on newly recorded mortgages, for the federally sponsored agencies and for most of the private lender groups.

There is much interest in the farm real estate holdings of leading lending agencies in knowing how much farm land these agencies have acquired in recent years. A study as of January 1, 1937, revealed that the leading lending agencies held about 28,000,000 acres of farm land in which they had an estimated investment of almost $1,000,000,000. This compared with $150,000,000 in 1929. The additional lands had been acquired primarily through foreclosures and other distress transfers.

COMMERCIAL LOANS INCREASED

Bureau surveys revealed an increase in both personal and collateral loans by commercial banks to farmers in 1937, but that during the latter half of the year there was a nominal decrease in loans secured by farm real estate. At the end of 1937 the agricultural loans of commercial banks totaled $1,289,801,000, an increase of 19 percent as compared with the end of 1936. Short-term agricultural loans of the federally sponsored credit agencies also increased substantially in 1937, the total at the end of the year being $192,480,000, representing an increase of 13 percent.

A study was completed of short-term credit supplied by country banks in Wisconsin in relation to the credit needs of Wisconsin farmers. during the period 1929–35, and a similar study was begun in Utah. The objective is to ascertain the changes in management policies which would have enabled the banks to serve the legitimate credit requirements of borrowers while meeting heavy demands from depositors.

A technique was developed by which country banks may determine approximately the total volume and types of securities they should hold in order to assure that they will be able, in case of an unfavorable turn in economic conditions, to meet withdrawals of deposits and at the same time render a satisfactory credit service to borrowers without help from other financial institutions. This technique involves a measurement of the risks of price depreciation inherent in various classes of securities and of the liquidation and losses that might reasonably be expected from various classes of local loans in case conditions became acutely depressed.

THE TAX PROBLEM

New taxes affecting farmers have become numerous in recent years, and new viewpoints, or added attention to views widely opposed in the past, have been increasingly in evidence. There is increasing need for study of newer forms of taxation, and for logical analysis of devices to modify the indirect effects of taxation, such as the

distribution of the tax burden, to make taxation more fully cooperative with other efforts to reach currently developing social objectives. The Bureau's farm real estate tax series are being kept up to date, and by the end of 1938 will have been extended back to 1890, by States. A slight upward trend in taxes per acre continued from 1934 through 1937. Its continuance for 1938 is suggested by advance data.

An important function of the Bureau has been the administration of the Bankhead-Black Act, passed in 1936, which authorizes the Farm Security Administration to make payments to local taxing units in lieu of taxes on real property included in resettlement projects of that agency. Up to June 30, 1938, 1,200 agreements for payments in lieu of taxes had been drawn up with 1,150 local taxing units, including States, counties, and school districts. Because of the growing importance of such payments, the Bureau has cooperated with other branches of the Department in an attempt to work out a uniform policy to govern relationships with local taxing units.

Research on such subjects as tax-collection procedure and assessment policies brought to light many opportunities for improvement in State legislation on this general topic.

EXPORTS UP, IMPORTS DOWN

The fiscal year brought a striking change in the agricultural export-import situation. Agricultural exports increased 158 million dollars or 22 percent over exports in the preceding fiscal year. The volume of exports was the largest since 1933–34. Imports of competitive agricultural products declined 279 million dollars or 32 percent compared with 1936–37.

This marked change in the foreign trade situation is accounted for primarily by (1) the more abundant crops of 1937 following years of drought and low production and (2) the less favorable economic situation in the United States which caused a marked decline in imports of certain products, such as wool, ordinarily imported in substantial quantities.

From the longer-time point of view the principal positive factor looking toward larger foreign outlets for our agricultural surpluses is the reciprocal trade-agreements program. The agreements, negotiated by the Department of State, recognize in a practical way the necessity of two-way trade—that we must buy if we are to sell. Negotiations looking toward an agreement with the United Kingdom have been in progress since April 1938. The United Kingdom alone accounts for more than one-third of the total agricultural exports of the United States. Negotiations were begun on a new trade agreement with Canada, and an agreement with Czechoslovakia was put into effect. Trade agreements are now in effect with 17 countries which normally constitute a market for more than one-fourth of our agricultural export trade. The Bureau collaborated closely with the interdepartmental committees established to carry out the trade-agreements program.

FOREIGN RESEARCH

A number of research studies concerning matters having a direct or indirect effect on the position of American agriculture in world markets were completed and published, notably studies of the ex-

panded cotton textile industries of China, Japan, and India. These studies showed conclusively that the rise of modern textile industries in the Orient has led to a net loss in the oriental market for American cotton. The increase in imports of American raw cotton, particularly by Japan, has been outweighed by the substantial loss in China and India of markets for American cotton in the form of goods.

A report was issued entitled "The Tariff on Long Staple Cotton and Its Effect," additional work was done on an analysis of the effects of our tariff policy on the cotton farmers, (this study should be useful to the cotton farmers in attempting to strike a balance between profits and the burdens of a high protective tariff policy), and some analysis was made of tariff rates and the cost of the tariff on representative articles bought by farmers.

An intensive field investigation of hog and pork industries, including first-hand surveys of hog production and marketing, was made in practically all of the European hog-producing countries. It indicates that, given an opportunity to compete on an equal basis with other exporting countries, the United States could maintain substantial European outlets for American ham and lard.

A study of foreign trade of the United States in meats and livestock revealed that the downward trend in exports of meats and livestock in the last 30 years has been the result of an expansion in demand in this country as well as a decline in foreign demand for these products.

A study of the British market for American tobacco showed that, owing to tariff preference, Empire leaf is supplying a greater proportion of the British demand for tobacco, although an increase in total consumption in the United Kingdom has made it possible for the United States to continue a high volume of tobacco exports to that country.

AGRICULTURAL SURVEYS

Two new series of research investigations were begun in individual countries: (1) Studies of important agricultural industries, and (2) general agricultural surveys. The first type of study is illustrated by reports published on Argentine corn and Argentine wheat. The purpose of such reports is to discover the basic factors affecting the production of the more important agricultural staples in foreign countries with particular reference to the competition they now offer or are likely to offer to American agriculture in world markets.

The second type of study is illustrated by a report on agriculture in Peru, which is a more general discussion of developments and trends with particular reference to those branches which are of especial interest from the point of view of competition with American agriculture. Similar studies are under way in Argentina, China, the Union of Soviet Socialist Republics, and countries of the Danube Basin.

Other foreign-research studies included such subjects as farm tenancy in Ireland, farm labor and social legislation in England, crop insurance in the Soviet Union, and a general review of Swedish agricultural policy. Government policies affecting agriculture in 13 foreign countries were reviewed with particular reference to developments in 1937.

The results of investigations and research on foreign production and foreign markets are made available in many ways to American farmers—in printed and mimeographed bulletins, weekly and monthly publications, daily newspapers and radio releases, and by personal contact with large groups of farmers. Talks are given at large meetings in various parts of the country by the Bureau's foreign investigators recently returned from abroad. There was a series of talks on world cotton production and markets to inform American producers as to trends in foreign competition, and to show them how American cotton-marketing methods may be improved to increase the competitive position of American cotton. Similarly, fruit producers and exporters are kept informed as to foreign market developments and the practical ways of expanding foreign trade.

In response to increasing demands for information on the agricultural import-export trade of the United States, the Bureau has virtually completed a new index of the volume of agricultural imports and a revision of the index of agricultural exports. These indexes should be useful in providing a clear-cut picture of the shifts and trends in our agricultural foreign trade.

LOOKING AHEAD

Surveys and analyses by the Bureau suggest some improvement this fall and winter in the demand for farm products, but that farmers will go into the 1939 season faced by excessive supplies of wheat, corn, and cotton. Factories confronted by a similar situation as to stocks of manufactured goods invariably curtail production. They did so in the fall and winter of 1937. Factories went on part-time production schedules.

Farmers in the fall of 1937 were planning their 1938 production, as they are now planning for 1939. In the fall of 1937, the Bureau held its seventeenth annual outlook conference of State and Federal economists and other specialists, studied the situation and prospects covering more than a hundred different agricultural products, made known the essential facts to farmers through the many ways developed by the Bureau and the Extension Service for the spread of agricultural economic information.

Wheat growers were informed of the prospects for lower prices in view of the likelihood of a burdensome supply situation, cotton growers were cautioned against excessive plantings, corn growers were informed that the supply of feed per farm animal was the largest in more than 10 years. The supply-and-demand situation and the outlook for all other agricultural industries were similarly analyzed and made known to farmers.

Monthly and special situation and outlook reports were issued during the planning season, discussing latest developments in domestic and foreign supply and demand conditions. Surveys were made as to the planting and breeding intentions of farmers. these preliminary plans for 1938 production were studied and analyzed in relation to all the basic supply and demand factors, and the conclusions made known to farmers by press and radio direct and through the agencies of the agricultural extension services.

Simultaneously, the facts as to prospective acreages and production in 1938, as to the surplus of products from the 1937 crops, as to the

prospective domestic and foreign demand for products in 1938, and as to the continuing need for readjustments in agricultural production as a whole and in its component parts were the subjects of agricultural planning conferences among economists and other specialists of the Bureau and the Agricultural Adjustment Administration. The Bureau was supplying the basic facts and analyses for use in organizing adjustment programs for 1938.

CROP INSURANCE

The Agricultural Adjustment Act of 1938 authorized the creation of the Federal Crop Insurance Corporation to insure wheat growers against losses in yields and to investigate the practicability of extending similar insurance plans to producers of other farm products. The crop insurance program was the culmination of years of basic research in this field by the Bureau.

The Bureau completed the compilation of premium rates and practical limits of insurance coverage per acre for wheat-crop insurance in more than 1,700 wheat-producing counties in 36 States. Premium rates were prepared for two coverages, one for 75 percent of the average yield and another for 50 percent of the average yield on insured farms.

It is believed that the premium-rate system which has been devised fits the rate closely to the individual farm risk, that it will enable farmers having low risks to obtain insurance without paying excessive costs, and that it will not encourage farmers having high risks to continue production where on the average such production is below subsistence levels.

A uniform technique was worked out for compilation of actuarial data for all types of wheat and in all wheat-producing areas. This became possible after special investigations were made (1) to ascertain the varying influences of soils, farming practices, and climatological factors on the yields of wheat, and (2) to determine what modifications, if any, were necessary for insurance on wheat produced on irrigated land and on land seeded to wheat following summer fallow.

Research work on crop insurance for cotton and corn was resumed and a study of the problems peculiar to crop insurance for certain fruits and vegetables was started. Upon the acquisition early in the coming year of cotton-yield data for the years 1933–37, the cotton study will progress rapidly. Work on corn and certain of the commercially important fruits awaits principally the gathering of additional data and the development of a definite plan of attack.

Following the enactment of the Federal Crop Insurance Act, the actuarial data for wheat-crop insurance were tested and checked extensively and turned over to the Federal Crop Insurance Corporation.

TEN MILLION SUBMARGINAL ACRES

Following passage of the Bankhead-Jones Act in 1937, the Bureau was charged with the responsibility for administering title III of that act providing for a program of land conservation and land utilization. On September 1, 1937, administrative supervision was assigned to the Bureau over the 131 projects involving 8,142,666 acres, in the land-utilization program previously carried out under the Resettle-

ment Administration. Subsequently, additional land purchases were authorized in 106 projects established by the Bureau under title III of the Bankhead-Jones Act. Land acquisition was in progress on 95 projects, both old and new, and authorization to begin acquisition was in process of being obtained for four others on June 30, 1938. Appraisal of 1,906,354 acres in projects authorized during the year was completed, options were obtained on 555,518 acres, and options were accepted on 132,502 acres. The purchase value of the land on which options were accepted was $677,307. Title-clearance work on the "old" (former Resettlement Administration) program including land-use and resettlement-type projects included delivery of checks amounting to $17,827,701 in payment for 2,645,394 acres, bringing the total amount of land paid for under the old program to 7,815,194 acres.

Three major types of projects are included in the land utilization program: Agricultural adjustment projects, isolated settler projects, and water conservation projects. Designed to convert wasted, misused land to uses that will rebuild natural and human resources into permanent national assets, the agricultural adjustment projects aim at establishment of a sound rural economy based on agricultural use of the land. Isolated settler projects are undertaken with the objective of enabling widely dispersed farm families, in nonagricultural areas, to relocate; thereby at once enabling local and State governments to reduce costs of public services to these citizens, and providing a means for economically more desirable use of the land. The third group of projects, those devoted to water conservation, are of special prominence in arid and semiarid regions where full and thrifty development of water resources is the dominant factor in establishing an economically healthy system of using the land.

LAND DEVELOPMENT

Land improvement and development, required in order that full use may be made of natural potentialities of the land acquired, included many types of work to meet problems peculiar to each project area. Broadly speaking, these developments included general land treatment, structural improvements, betterment of transportation facilities, control of erosion, flood control and water storage, forestry, recreation, and wildlife. In these activities, $17,310,548 was spent, of which $7,185,135, or 41.5 percent, was for labor.

Improvements on submarginal land included the building of approximately 8,000 acres of public camping and picnic grounds, and 347,892 check dams (to stop soil erosion); the seeding of 60,542 acres of land to grass; planting of 121,786 acres to trees; the construction of 396 miles of fences (to facilitate management); the improvement of 582,923 acres of forests; the building of 4,043 miles of highways, roads, and truck trails, and the erection of 981 structures, including houses, barns, sheds, administrative buildings, and recreation shelters. In its water-conservation work on land use projects, the Bureau had by June 30, constructed 1,410 dams, of which 93 are classed as major impounding dams, the remainder being largely stock reservoirs on the Great Plains range projects.

Development work was performed on 93 projects, covering 6,667,169 acres, with average monthly employment approximating 18,000

workers. Virtually all of the development work was accomplished with relief labor from the vicinity of each project, furnished by the Works Progress Administration. In most cases, the workmen had to be trained as they worked in such crafts as stonemasonry, carpentry, operation of heavy equipment, and numerous others. As these men acquired skills, many were able to find positions in private employment.

NEW USES FOR LAND

Increasing emphasis was placed on the management of project areas as development progressed to the point where they were ready for new uses. An example of this management work, and the ultimate adjustments to be achieved in the agricultural projects in this program, is a sample area in Wyoming. In a 100,000-acre area, where farm poverty, depletion of soil and grass resources, need for relief, and tax delinquency were becoming widespread, 41,279 acres of small farm units, abandoned homesteads, and other lands were acquired. To help convert the land to range use, fencing and increased water facilities were developed and considerable areas reseeded to grass. The number of operating units was decreased from 54 to 25, and the use of the land organized so that all remaining operators who wished to cooperate in the program now have sufficiently large operating units for successful management as stock ranches. These operators, moreover, have now become eligible for rehabilitation loans and commercial credit and none are on relief rolls.

Representatives of the Bureau (or preceding agencies) assisted local operators in forming a cooperative grazing association which now leases the Bureau's land along with other tracts not directly controlled by local operators. By virtue of the management plan worked out by the Bureau in cooperation with this local grazing association, all land is being used in such a way as to protect the soil and grass resources, build up the carrying capacity of the range, and yet enable each operator to get the greatest return from the land consistent with these policies. Similar programs are being put into effect in all but a few of the 18 projects covering 3,928,612 acres being managed by the Bureau.

Many of the projects included in the old program were best adapted to administration by other agencies of the Government. Therefore, 45 projects or parts of projects, including 1,749,327 acres, were transferred during the fiscal year to other Federal agencies. Of the remaining projects, on that date 25 projects, including 597,909 acres, in whole or in part, were scheduled for such transfer. Since a major objective in the land utilization program has been to obtain the widest possible local participation by individuals, State agencies, and political subdivisions, cooperative arrangements have been or are being made with State agencies for transferring to them the administration of land in a number of projects. Prior to June 30, 1938, one project had been transferred, while temporary management agreements had been made for 14 projects. The projects have been developed in close cooperation with State agencies, usually those with which negotiations are being conducted looking to permanent administration.

COOPERATIVE LAND DEVELOPMENT

Of special interest has been the development of the cooperative phase of the program, insofar as it assists in development of local organizations or units dedicated to sound permanent management of the land. Many projects have afforded the basis for cooperative grazing associations, development of community pastures, or other devices directed to this end. In its effect on individuals, the opportunity the program has afforded many families of relocation on better soil should not be overlooked.

On the more than 8,700,000 acres in the original program, of which 94 percent was transferred to the Bureau, 12,865 families were living. Of that number, 217 were shifted to better farms within project areas while 9,303 moved outside the project areas. Some of the latter-named group were given financial aid. The relocation of families, primarily concerned with the removal of submarginal land from cultivation, is also designed to encourage the shifting of families to lands more suitable for cultivation. Definite plans had been made for relocation of most of the remaining families, either through their own efforts or with the small loans or guidance from other Federal agencies.

Much information was assembled for various programs of Federal and State agencies. The Bureau advised with the States in regard to such measures as rural zoning, cooperative grazing organization, and improved tax laws, that can be used to direct the use of their land resources. In Michigan, for example, State authorities were given advice on policies to be followed in getting the new State rural-zoning program into action. In Tennessee and West Virginia, special surveys of land problems were made with a view to determining the possibility of applying rural zoning ordinances to their solution.

In almost every one of the land utilization projects located in the Great Plains, cooperative grazing associations, or similar groups, have been organized locally to lease and manage the land purchased by the Bureau, as well as the land within the area owned by non-operating private owners. Through application of this directional measure, the effects of land purchase have been extended over an area four or five times as large as that actually acquired. A program was continued in cooperation with the State of Minnesota to classify the tax-reverted lands in northern Minnesota with a view to withdrawing from future sale those that were determined to be unsuited to agricultural settlement.

Zoning, cooperative grazing districts, soil conservation districts, land purchase, and other directional measures to a considerable extent supplement each other; sometimes their influences may overlap. Clarification of the functions to be fulfilled by each of these measures is necessary. For this purpose a study has been initiated in Yellowstone County, Mont., to test the values of the respective directional measures in relation to a specific set of problems, and to show how each may be assigned its proper place in an integrated program of land use adjustment.

WATER UTILIZATION

Considerable research and planning in the field of water utilization, a synthesis of engineering and land economics, has been initiated by the Bureau to determine the availability of water for various uses, and the ways in which the water may be utilized to achieve a more stable and constructive use of land.

Extensive water developments in land utilization projects, particularly in the Great Plains, have necessitated special exploratory surveys of existing supplies of water. As material concerning water resources has been assembled, certain definite problem areas have been demarcated, wherein an improvement in the use of water is vitally essential to the rehabilitation of the population and sound use of land.

Information concerning these problem areas, and concerning areas of water shortage, has been widely used by other agencies. A land- and water-use plan was completed for the Rita Blanca area in Texas and New Mexico. It is expected that this basic information on water-and-land economics will be of great value to the water-facilities program, scheduled to begin operations early in the fiscal year 1939. The Bureau participated in an intensive study of water and land resources in the State of North Dakota, helping draw up a plan for long-time improvement in land utilization in that State.

FLOOD CONTROL

Jointly with the Forest Service and the Soil Conservation Service, the Bureau has served on the Department's flood-control program. Its responsibility has been the assembling of social and economic data. How does the local agricultural economy of an area affect the run-off of water and consequent flood hazards? What changes in land use and types of farming are necessary and possible to encourage a better control of waters, and how can excess flood waters be used to promote better land use? These are some of the questions regarding flood control which the Bureau's investigations attempt to answer. By the end of the year, 30 watershed reports had been prepared, and 2 detailed investigations have been initiated in Texas and California.

RESETTLEMENT

Everywhere land-problem areas are characterized by over-population. If natural resources are to be conserved, some of the people must move elsewhere. Where can they find other opportunities? The Bureau has studied the opportunities for resettlement of emigrants from overpopulated regions such as the dust bowl, and investigated what has happened to refugees from drought who settled on farms without guidance from any source, and with little or no capital. Facts revealed in these studies have evidenced the drastic need for the Government to guide emigrants to lands where they can at least make a living. A special investigation was made of the opportunities for combining part-time forestry with farming in the Southeastern States. A report is in process of completion.

ACTION PROGRAMS

The Bureau has focused its land planning for the most part on the development of action programs, instead of confining itself to pure research. And in doing this the programs are being developed on an area basis—covering a given county, watershed, or other geographical unit. Fourteen area programs were intensively developed during the year; others are in preliminary stages of development. A study on a land program for Forest County, Wis., included, for example, the findings of all land use investigations in this area: Land ownership, history of settlement and exploitation, development of industries, local government, and other descriptive data. To this was added a proposed program including land acquisition, rural zoning, local governmental reorganization, and resettlement, that will, in the opinion of the technicians responsible for the report, result in the best use of the land resources of this county.

RURAL LIFE

The way of rural life has vastly changed in the last quarter century. For many farmers it has changed for the better, but for too many the living conditions are no better, and in some cases they are worse, than in earlier times. Hundreds of thousands of farm families are living under conditions far below the much vaunted high standard of American life.

Recent surveys show a marked improvement in farm living during the present decade. Physical burdens on the farms and in the farm homes have been lessened, public and private facilities making for a higher social and cultural order have been increased. But the improvement has been chiefly in the North; in many areas of the South, the living conditions of farm tenants and share croppers are worse than those commonly associated with city slums.

Much fundamental research is needed as a basis for governmental action designed to improve farm living conditions. To this end the Bureau has brought together the available information concerning the disadvantaged classes in American agriculture. It reveals the areas of concentration of low-income farm families, hired farm laborers, farm tenants, farm families on poor lands, migrating farm families, and farm families on relief and with low standards of living.

These data have been assembled in a report entitled "Disadvantaged Classes in American Agriculture." By showing how the various areas of concentration tend to coincide, this publication reveals the sore spots in American rural life and the major factors which tend to reduce approximately one-third of the farm population of the Nation to submarginal standards of living.

FARM POPULATION

The Bureau annually estimates the changes in farm population, but has been able to do little by way of studying the reasons for these changes and for the vast annual migrations between farms and cities. During the year approximately 1,160,000 persons moved off the farms, and about 872,000 moved from towns and cities to farms. There were also the usual shifts of farmers moving to other farms.

Business recession, drought, and farm mechanization were among the principal factors affecting farm population shifts during the year. There was a net migration off the farms amounting to 288,000 persons, but this decrease was more than offset by an excess of farm births over deaths. The total farm population was 31,819,000, close to the largest on record, as of January 1, 1938, compared with 31,729,000 in 1937.

The Bureau is trying to improve its techniques for estimating changes in farm population, utilizing different methods of selecting samples, making special efforts to reach important foreign-language groups, and making field checks on errors involved in the use of mailed questionnaires. Indexes of standards of living are being developed so that important information on this subject may be collected less expensively than heretofore.

FARM TENANCY

A pioneer study of the increasingly acute problem of farm tenency was instituted, dealing with the psychology of farm people and their reaction to governmental programs of action that seek to solve the farm-tenancy problem. Technical assistance was given Federal and State agencies, as in connection with the committee on farm tenancy appointed by Governor Kraschel of Iowa, last year, to investigate the present status of tenancy in Iowa and recommend steps for its improvement. The Bureau provided this committee with much research material and participated in its hearings and studies. Two reports on Iowa tenancy were prepared by Bureau personnel, one in cooperation with a representative of the State. The bulletins were published by the State agricultural experiment station. In making its recommendations the Iowa tenancy committee also draw upon much of the Bureau's data developed in earlier studies of this problem.

Similar work was done in cooperation with a committee on farm tenancy appointed by Governor Bailey of Arkansas. Further work in that State is to be done during the ensuing year. Besides cooperating in these State programs the Bureau helped the Farm Security Administration plan its farm-tenant purchase program.

FARM LABOR

A series of 11 reports was released giving the results of farm-labor surveys financed by the W. P. A. in the summer and fall of 1936. Representative areas of the Corn Belt, the Wheat Belt, the cattle and sheep country, and the tobacco, cotton, and dairy regions—areas where farm labor is employed the year round and areas where hired hands are needed for only a short time during the harvest season—were covered by these surveys.

The investigators found laborers of all races and abilities; young men and old, and some women. Some had hope of eventually becoming farm owners, but many were stalled on the lowest rung of the agricultural ladder. More information of this sort is needed. Information is needed regarding the underlying conditions affecting farm-labor supply and demand, and the wages and living conditions of farm laborers.

Studies are needed also of the present and prospective economic and social consequences of farm mechanization. Twenty years ago, vast armies of farm laborers were employed in the wheatfields; today relatively few men do the work of many. Similar changes have occurred, but in lesser degree, in other agricultural industries where machines have replaced men. Economists and sociologists are deeply concerned now over the probable effects of increasing farm mechanization in the South.

FARM MANAGEMENT

Major emphasis was given to the coordination of farm-management research and planning for action programs. Subjects included land utilization, agricultural conservation, soil conservation, rehabilitation, the profitable use of range lands, and agricultural adjustment and type-of-farming studies.

Farm-management investigations, made as a part of the land utilization program in the two Great Plains areas, included: (1) Continuation of the studies begun by the Land Use Planning Section of the Resettlement Administration in the southern Great Plains dust bowl area; (2) a study of pump-irrigation possibilities in the area adjacent to Hereford, Tex.; (3) special studies of adjustments in operating units needed in conjunction with the administration of purchase projects; (4) economic analysis of soil conservation districts; and (5) analysis of Agricultural Adjustment Administration data in county offices.

The most important activity in the northern Great Plains was a study of desirable agricultural adjustments in central South Dakota. The area under study lies in the transition zone between the major ranching and farming areas. It seems probable that arable farming will be continued in this area but that some drastic readjustments in sizes and types of operating units are needed to establish self-supporting farms on a long-term basis. A number of Federal action agencies are vitally interested in the results of this study.

The Bureau has assumed increased responsibility for the direction and supervision of studies designed to assist the Agricultural Adjustment Administration in the revision and formulation of programs that will more adequately achieve the long-time objectives of soil conservation and economical use of agricultural resources. A major activity was a review of the first 5-year period of operation of Agricultural Adjustment Administration programs from the standpoint of soil conservation and efficient farming. Although the programs under the original act did not operate directly through specific features to promote the long-time objectives of soil conservation and more efficient farming, and in some instances they were definitely retarding factors, they may be considered to have contributed potentially to the eventual accomplishment of these objectives.

Cooperative studies of certain aspects of Agricultural Adjustment Administration programs were begun in Illinois, Kansas, New Hampshire, Iowa, Virginia, Indiana, Arkansas, Tennessee, Maryland, North Carolina, Ohio, and New York. Tenancy and labor studies were made in the Mississippi Delta, Arkansas, South Carolina, and Illinois.

The Bureau cooperated with the Soil Conservation Service and with 17 State experiment stations in studies of the economic aspects of soil and water-conservation methods and practices. These studies

had as their objectives either one or both of the following considerations: (1) An evaluation of the effects upon crop yields and soil productivity of specific soil conservation practices applied within local areas; (2) an economic appraisal of the probable effects of changes in land use for conservation purposes upon systems of farming and farm incomes.

REHABILITATION PROGRAMS

The program of the Farm Security Administration indicates the need for knowing the conditions on individual farms as a basis for action. In the rehabilitation phase of this program loans are made to farmers that will permit individual operators to reestablish themselves on a self-supporting basis. Farm-management studies are needed in local areas to answer the questions of the size and type of business on which rehabilitation clients have the best chance to succeed.

A study of rehabilitation prospects in the Great Plains States indicated that in the better farming counties in the eastern part of this region there is little need for a widespread rehabilitation program, and that in a few of these counties there may be opportunities for a closer settlement. Rehabilitation needs in such areas arise primarily from a shortage of working capital and the need of funds to protect the operators' equity in farm property.

In the western areas of low or variable land productivity it was evident that some sections had been too closely settled, that a more extensive type of farming would be necessary to stabilize farm incomes. In the most distressed areas drastic adjustments in land use, in the size of the farm unit, and in the type of production seem desirable. In such areas public action will probably be necessary to induce the adjustments needed.

A study of small ranches in eastern New Mexico was made to analyze, if possible, the income prospects of southern Plains wheat farmers who would shift to a small ranch type of farming. This is of special interest to the Farm Security Administration in making loans to farmers who wish to make this change. In cooperation with the University of Minnesota a study was also made of the financial progress of rehabilitation clients.

RANGE PROBLEMS

A study was made of ranching problems in Elko County, Nev., the following agencies cooperating: Bureau of Agricultural Economics, Forest Service, Agricultural Adjustment Administration, Division of Grazing, Bureau of Indian Affairs, Farm Credit Administration, Nevada Agricultural Experiment Station, and the Nevada Extension Service. A representative of the Bureau is project leader. The study was initiated to work out plans for the use of the agricultural resources of the area that will lead to the greatest and most enduring prosperity.

Results of this study will be of direct use to those responsible for administration of the public range land, to all who are interested in conservation of agricultural resources, and to agencies responsible for the advancement of credit. It represents an interesting effort to

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coordinate the activities of all agencies concerned in the agricultural problems of the area. It is hoped that the study will suggest a well-rounded area-adjustment program that will meet with the approval of various educational and action agencies and as a result will be actively sponsored by them.

TYPE-OF-FARMING RESEARCH

Active participation on cooperative studies in type-of-farming and agricultural adjustments were continued in Montana, Texas, West Virginia, Mississippi, and Wyoming. New projects of this type were started in Maryland, New Mexico, Alabama, and Georgia. In the Montana study, the objective from the start has been to provide definite and localized information on the organization of Montana farms and ranches and their income prospects for the guidance of action agencies in their programs. A technique has been developed for constructing records for individual farms and ranches from secondary sources. From these records estimates have been made of income prospects from different sizes and types of farms in specific locations. From this material suggestions are made regarding adjustments necessary for establishment of self-supporting units on a long-term basis.

LOCALIZED AREA STUDIES

Localized area studies of farm-adjustment problems were conducted jointly with agricultural experiment stations in 13 areas of 11 States. These studies permit detailed analysis of important problems on which adjustment efforts should be centered. An illustration is the study of the High Plains cotton area of Texas. This area shows a rapid shift from horse to tractor power in the period from 1931–37. This change, which also involves two- and four-row cotton machinery, may have far-reaching effects on the sizes and the number of farms in the area, and hence on the number of farm people that may be displaced by the introduction of tractor power and large-scale machinery. Estimates have been made of the number of farms needed to produce the 1934 cotton crop in five High Plains counties, assuming the use of various power and equipment units. If tractor-drawn two-row equipment were used on all the land in this area the crop could be produced with 58 percent of the actual number of farms in the area in 1934. If tractor-drawn four-row equipment were used only 33 percent as many farms would be needed.

COMMODITY STUDIES

Commodity studies and special projects in the field of farm management dealt primarily with production costs, farm incomes, and farm practices. Several of these studies are continuous, others represent timely inquiry into problems of special interest. Projects included a study of hogs in Georgia; the efficiency of dairy farming through dairy herd-improvement association records; yields, prices, and returns of apple varieties in the Cumberland-Shenandoah and neighboring areas; organization and crop-production practices on grain farms in selected areas of the Great Plains and in the Pacific

Northwest; cost of producing corn, wheat, oats, and cotton; cost of producing fruit and truck crops; farm returns; coordination of farm-business-analysis studies; and wildlife as a supplementary farm enterprise.

The Bureau is taking definite steps to meet the needs of action agencies for farm-management information. A section dealing specifically with coordination of farm-management programs has been organized. However, there is still need for longer-term research studies of certain outstanding farm-management problems. In each major agricultural region there are certain serious farm-adjustment problems that should be studied. These include such subjects as the alternatives to cotton production in view of the economic outlook for cotton, the operation of noncommercial farms, and the effects of technological improvements on family farming.

BASIC STATISTICS

The Bureau is looked upon as the central governmental source of all kinds of domestic and foreign statistical information relating directly or indirectly to agriculture. Individual statistical series collected and compiled regularly find uses in countless ways by researchers, farmers, business men, and students. The Bureau's crop and livestock reporting services are the basic source of farm-production information upon which most of the economic research of the Department and the State colleges, as well as private organizations covering the agricultural field is based.

Forecasts and estimates were made of the acreage, production, stocks, sales, utilization, and prices of practically all crops grown in the United States. Estimates were made of the numbers of all classes of livestock on farms, and of the production, sales, disposition, and value of livestock. Forecasts were issued of the numbers of hogs, sheep, and cattle available for market.

Estimates were made of milk production, utilization, and sales, and reports issued as to the quantities of various products manufactured from milk. Estimates were made of poultry and egg production, and of the numbers of chickens and turkey poults commercially hatched. Estimates and index numbers were made of prices farmers received for products and of prices paid for things they bought, and estimates of the farm-labor supply, demand, and wages. Reports were issued on the movement of agricultural commodities by rail, boat, and motortruck. Research included the relationship of crop yields and weather phenomena.

The crop and livestock reporting organization also acted as a service unit in the collection of a wide variety of economic data relating to movements of farm population, land values, taxes, farm expenditures, cost of production, farm tenancy, and production and sales of forest products.

COUNTY ESTIMATES

There was an unprecedented increase this year in the demand for agricultural statistics, especially for areas smaller than States, such as crop-reporting districts and counties. Some district information

was included in the reports released by the different State statisticians. It was possible to prepare comprehensive data by counties in a few States where cooperation is in effect with a State agency and there are State laws requiring annual censuses of agriculture. Some special county estimates were prepared for the Agricultural Adjustment Administration using funds allotted for this purpose. The preparation of county estimates generally would require an expansion of the field service to permit the making of extensive annual field surveys.

The Bureau collected for the Agricultural Adjustment Administration a large volume of special statistical data for use in the soil conservation and crop-control programs. These data covered a wide variety of subjects ranging from county estimates of cotton, wheat, corn, rice, milk cows, and other cattle to special price reports, and advance estimates on certain crops such as cranberries and sugar beets. Efforts are now being made to tap, for use in preparing more exact county figures, the vast store of information relating to crop acreages that is being accumulated in various States in connection with the administration of the Agricultural Adjustment Acts.

INCOME PARITY

Much statistical research dealt with projected revisions of indexes of prices received and paid by farmers during the last 28 years. Research relating to income parity for agriculture included a complete revision of the estimates of farm income for about 90 different commodities, placing all estimates on a calendar-year basis from 1910 to date and breaking them down by States since 1924, or for a longer period where State data are available. Data relating to farmers' expenditure during the period 1910 to date were revised and expanded. Information relating to nonfarm income of persons on farms was analyzed and summarized, and available information on national income (excluding income of persons on farms) was assembled.

In last year's report was described some of the work that had been done in developing a method of treating time series so as to overcome the difficulties introduced because of serial correlation. In 1937–38 this method was applied to additional series, including egg prices and egg receipts. Definite evidence was provided, by the use of this method, of a changing seasonal variation. None of the methods now in common use would have shown this change so definitely if at all. It was found that the relation of receipts to prices is not so close as is indicated by the ordinary methods.

It is planned to simplify the routine and complications of this procedure, and to present it for the use of other analysts. Also, a further investigation of the peculiarities of the serial correlation existing in various forms of price series has been started. One result of this work is an article by a member of the staff entitled "Serial or Coherent Correlation in Price Series," which appeared in the Journal of Farm Economics, for May 1938. Plans were made for setting up a separate unit within the Bureau for the purpose of developing more appropriate methods of analysis in relation to time series, particularly prices.

STATISTICS FOR USE

In response to the needs of public and private agencies, the Bureau has sought increasingly to supply statistical services of practical value in solving national, regional, and local agricultural problems. Sources of statistical information have been greatly improved in recent years, and increasing effort has been made to interpret this information for the common understanding. Figures are not gathered for their own sake, but for the light they may throw upon the complex problems of a commercial agriculture.

Besides statistics of agricultural supply, demand, and prices, the Bureau gathers and interprets many series in related fields that affect the Nation's agriculture. It makes many special statistical studies at the request of public and quasi-public agencies, and is continually filling requests for information from individuals, groups of individuals, and organizations of one kind or another. A large volume of statistical research was done for State and Federal agencies engaged last year in formulating new agricultural adjustment programs.

The Bureau contributed in many ways to making the statistical foundation for adjustment programs more adequate and reliable. Price analyses were made as an aid to the administration in promulgating loan programs for wheat, cotton, corn, wool, and mohair. Material was prepared for use by the Secretary of Agriculture in hearings before the Interstate Commerce Commission with respect to the request of the railroads for a 15-percent general increase in freight rates.

A study of foreign markets for, and the possibility of, increasing exports of tobacco, in accordance with Senate Resolution 291 was made. Prospective domestic and foreign supply and demand conditions were analyzed from the standpoint of arriving at desirable production goals for agriculture in future years, and the material was used in discussions with extension workers and others designed to add to public understanding of the problems involved.

In November 1937, the Bureau of Internal Revenue of the Treasury Department published an exhaustive report prepared by the Bureau entitled "An Analysis of the Effects of the Processing Taxes Levied Under the Agricultural Adjustment Act." Release of this publication was followed by many requests for conferences with attorneys and economists interested in the findings, particularly with respect to cases pending before the Bureau of Internal Revenue. Many requests for statistical information and analyses were received from members of Congress.

STANDARDIZATION AND INSPECTION

Previous reports have detailed the Bureau's standardization, inspection, and market news services instituted nearly 25 years ago. Annually, these activities have been expanded at the insistence of producers, shippers, processors, and distributors of farm products. Quality standards have been developed for all the principal farm products—cotton, wheat, corn, feed grains, hay, livestock, meats, butter, eggs, dressed poultry, fruits, vegetables, and many others. Inspection services have been put into effect to certify the quality of products marketed under these standards.

Both services, standardization and inspection, are administered under specific legislation, such as the Grain Standards Act, Cotton Standards and Cotton Futures Act, and other authorizations by Congress. Greatest use of these services are made by producers, shippers, and dealers to facilitate trade in the various commodities. Increasing effort is being made also, with the cooperation of processors and distributors, to extend the benefits of the Bureau's food standards to consumers. Large quantities of canned foods, dairy products, poultry products, and meats were Government graded and labeled as to quality last year.

Large quantities of standardized and inspected products were marketed during the year, and there was much research looking toward the improvement of standards and the development of new techniques in their formulation and administration. The effort is to substitute exact mechanical, chemical, and other tests and devices for the human judgment and skill that involve human variations. Whereas in former years it was often necessary to describe a factor of quality in rather general terms, it is now possible, in many cases to give it a specific value. Where expert estimation was formerly used there are now apparatus or tests that measure exactly.

An improved cotton-fiber sorting machine permits the measuring of fiber lengths with a high degree of accuracy, a bundle fiber test for strength of cotton fibers, and an improved cotton-waste analyser separates the different elements in the waste for intensive study. A saccharimeter is used to determine the sugar content of grapes, a sugar-acid test is made to learn the maturity of citrus fruits, and the specific gravity test is used to learn the maturity of cantaloups in the States that have laws prohibiting the shipment of immature melons.

Penetrometers ascertain the consistency of certain canned products, hydrometers test the density of sirups, salinometers test brine solutions, and a fruit pressure tester is used to ascertain the maturity of canned peaches and pears. Notable progress was made in developing techniques and apparatus for measuring the color of products. The Bureau's technicians are studying changes in cotton colors and the conditions or combinations of conditions that are likely to bring about these changes. Degrees of color are important quality factors.

Many public-service patents have been issued to Bureau workers who have invented grain standardization and grading devices. They include the so-called Boerner sampler which is used to divide large samples of grain into aliquot portions for inspection purposes. In grading grain for export, the public-patent ship sampler takes complete cross sections from the falling grain as it leaves the delivery spout for the hold of the ship, so that several samples, when combined, accurately represent a shipment of grain. A standard method of determining the protein content of wheat has been developed and is now in use.

GRAIN STANDARDS

At the close of the year there were 407 licensed grain inspectors under the Grain Standards Act, inspection was available at 175 points in 32 States, there were 46 Federal grain supervision offices at the important grain markets. More than 1,250,000 carloads of grain

were inspected, and the Federal supervisors handled nearly 80,000 appeals from these original inspections.

Grain-standards research pertained principally to (1) a continuation of research on the grade factor "shrunken and/or broken kernels" in the wheat standards and to the quantities of such material found in representative commercial lots of country-run wheat, exelevator wheat, and export wheat, and (2) a continuation of studies pertaining to the malting properties of barley, especially barley of far-western production, and to grade factors to indicate such properties.

Technological research in connection with instruments used in grain grading included studies of newly designed electric moisture meters, improvements in grain-sieving and sizing devices, and the perfection of a practical and rapid chemical method for determining fat acidity in corn. Many milling, baking, and chemical studies were made in testing the commercial value of new wheat varieties.

In cooperation with the extension service of the Department 108 grain-grading schools in 18 of the important grain-producing States were held during the year at which 9,193 grain producers, shippers, and elevator operators were in attendance. The objectives of these grain-grading schools are principally to improve seed quality, to improve quality of grain shipped to the terminal markets, and to demonstrate to grain producers the defects in market grain which cause discounts but which may be avoided by the adoption of remedial methods on the farm.

Important service was rendered the Agricultural Adjustment Administration and the Commodity Credit Corporation in conjunction with the Federal corn-loan program. Numerous training schools were organized and conducted at which moisture testing of corn was demonstrated to the Commodity Credit Corporation employees responsible for the evaluation of ear corn in farm cribs tendered as collateral for Federal loans. Throughout the year periodic supervision of moisture-testing activities for this purpose was conducted.

Federal-State permissive rice-inspection service supervised by the Bureau was conducted under agreements with the States of Arkansas, California, Louisiana, and Texas. Federal rice inspection was conducted at New Orleans. Four rice-inspection laboratories were operated in the Southern States, and three in California. The Bureau also rendered material assistance to the Federal Surplus Commodities Corporation in the purchase, inspection, and documentation of 641,900 hundredweights of milled rice in the Southern States for national relief purposes.

MARKET NEWS

The Bureau's market news services—reporting supply, demand, and price conditions at primary and terminal markets—now covers all the leading farm products. Besides increasing the scope of these services for the information of producers and shippers, continual research seeks to improve them, to make known to farmers the essential facts needed in the orderly and efficient marketing of their products. Modern methods of acquiring and disseminating market news are being increasingly used, notably the radio, which puts the reports directly into the farm home almost as fast as conditions

change in the markets. (This radio service is conducted practically without cost, through the cooperation of the various national radio chains and radio broadcasting stations.)

NEW COTTON SERVICES

A South-wide cotton classing and market news service is the Bureau's latest development in standardization, inspection, and market news work, to improve quality production, to secure for farmers proper premiums and discounts in cotton prices. The service is available to groups of farmers organized to promote the improvement of cotton. The new service went into effect on July 1, but already the requests for cotton classing and market news are taxing the facilities that have been set up.

The new cotton classing and market news service is a logical development of work done in this field on a limited scale in recent years. Producers have appreciated the ability to appraise more accurately the market value of their cotton, to compare the quality outturn of different varieties on their own farms with the cotton produced on other farms in their communities. Nearly a third of the cotton handled by cooperating ginners during the past year was bought and sold according to the Government class or with the Government class used as a guide.

There were increases in the number of bales of cotton classified and certificated for delivery on futures contracts under the Cotton Futures Act, and in the classing of more than 6,000,000 bales under the Cotton Standards Act. Some 464 classers were licensed under the Cotton Standards Act, compared with 301 in 1937. More than 3,000 grade boxes of the official cotton standards and 9,850 staple types, were prepared for public distribution.

Cottonseed grading and market news services were inaugurated in the Mississippi Valley States. Cottonseed samplers and chemists were licensed, more than 1,300,000 tons of cottonseed sold or offered for sale to crushers were sampled, 52,286 grade certificates were issued. The market news service included immediate publication of all changes in the price for base grade seed, and a weekly review of the cottonseed market by counties in each State.

COTTON RESEARCH

Much of the technological research in cotton is a scientific effort to learn more about the physical and chemical properties of cotton, to improve the Government grades so that they may more accurately represent the quality of the crop, to improve the mechanical processes of ginning and spinning cotton so as to reduce waste and lessen deterioration of cotton from field to mill. In modern laboratories cotton is subjected to all the ordinary tests, and to many extraordinary ones invented by the Bureau's technologists, for strength, color, and structure.

Considerable special technological research is done, as for example, into the average strength of yarns and cords from a given crop. Studies are also made of rainfall, temperature, and other growth data in an effort to explain the spinning and yarn differences of cotton from different crops. Complete fiber tests are under way.

Steady expansion of industries that process cotton linters in the manufacture of an increasingly wide variety of chemical and other industrial products emphasizes the need for fundamental technological research and service to growers in this field. The Bureau makes an annual survey of the quality of cotton linters, issues reports showing the estimated number of bales of each grade of linters produced and the percentages by States. A weekly review of linters prices is issued. Last year, 90 standard grade boxes for linters and 40 expositor types were distributed.

Fifty years ago cotton was a single crop. The seed, except as needed for planting, was a total waste. Cotton is now a duel crop with the lint ranking first and the seed second in farm value of products grown in the Cotton Belt. Farm income from cottonseed ranks about tenth or eleventh of all farm crops in the United States. Standards for grading cottonseed have been established by the Bureau, and a limited market news service is maintained, making price information available to producers and enabling middlemen who buy cottonseed direct to pay prices more nearly in relation to the actual value received from the seed.

GINNING AND SPINNING

Cotton ginning investigations in cooperation with the Bureau of Agricultural Engineering now place more emphasis upon problems involved in attaining normal capacity of gins without dense seed-roll operation and associated damaging effects on lint quality; upon economical methods and apparatus for conditioning, handling, and unloading seed cotton at the gin; and upon the accumulation of data for use in demonstration and extension activities.

Various types of cotton driers recently developed by the Bureau's laboratories along with other combinations of drying and cleaning facilities that have been advocated are proving their worth over a wide area. Adverse weather conditions over much of the Cotton Belt last fall afforded a conclusive test of the effectiveness of this equipment, about 1 million bales of cotton being dried by more than 550 driers in commercial gins.

The work of the spinning project was continued in the two field cooperative laboratories at Clemson, S. C., and College Station, Tex. Previous theories in regard to the importance of fineness of fiber as an element of quality, first demonstrated in the Bureau's laboratories in the spinning and testing of Hopi cotton, as well as Hopi-Acala crosses, were confirmed by tests on an entirely different variety of cotton. Two selected samples of different strains of a commercial variety were found to possess practically the same length of fiber, but one sample was found to have an average fiber weight per inch 22 percent less than the other. Yarns spun from the finer cotton averaged 32 percent stronger than those from the coarser cotton and manufacturing performance differed strikingly for the two cottons.

NEW FABRICS

Major emphasis in developmental work was placed on the preparation of new fabrics and specifications, many of which are being used experimentally in connection with the Department's cotton-diversion

program. A new type of raw-sugar bag with special reenforcement was designed to withstand stevedore hooks which constitute a major difficulty to using multiple-trip bags. A limited amount of work was begun in developing new methods of finishing and treating cotton fabrics. A study was made of the use of cotton in fertilizer bags. Ten years ago only a little less than 3 percent of the fertilizer consumed was packaged in cotton. Fertilizer bags required the equivalent of about 17,000 bales of cotton in 1937. Potential requirements of this use are estimated at more than 130,000 bales. A study of recent developments in the field of synthetic fibers yielded much information with regard to fibers that compete with cotton.

SAMPLING COTTON

Work was started on a project designed to provide a better system of sampling cotton and for coordinating this system with marketing procedures. Equipment was devised for sampling bales automatically while they are being formed at gins, to provide a true cross section of each bale and to eliminate the human equation in the drawing, wrapping, and identifying of samples with the bales from which they are drawn. When this equipment is perfected and its use coordinated with marketing procedures, it is believed that costs incident to marketing cotton can be materially reduced.

Letters patent were obtained for a permanent identification tag for cotton bales. The use of this tag in American cotton bales would facilitate marketing procedures and would tend to eliminate careless and irregular practices now associated with the packaging of American cotton. But in order to realize the full advantages of this device it will be necessary to provide for its universal use in American raw cotton. This could be accomplished by a statute requiring an identification tag in all bales moving in commerce.

FEED GRAINS

Farmers produced this year about 95 million tons of the four feed grains—corn, oats, barley, and grain sorghums. To this must be added the supply carried over from last year. There was a small increase in livestock numbers this year, but the supply of feed grains per grain-consuming animal is close to the largest in 12 years. In addition, the supply of hay is probably the largest since 1927.

This situation completely reverses conditions during the recent period of droughts which made necessary the importation of feed grains. Instead of imports this marketing year, the Nation has exported more than 130 million bushels of corn, and the prospects for this fall and winter are for continuing large exports of corn in view of the small Argentine supply.

The Bureau keeps closely informed on the feed-grain supply and demand situation so that grain and livestock producers may properly plan and put into effect their production and feeding programs. Two important phases of the Department's research program covering forage crops were completed: (1) A comprehensive outline covering the whole field of forage research; (2) a survey of important forage-research work in the Department and in the State agricultural experiment stations. Part 3 of the program deals with ex-

pansion and acceleration of important phases of the work now under way; part 4, with new phases of program that should be developed.

There was a steady increase in requests of individuals, newspapers, and radio stations for market news on grain, hay, and feed. No changes were made in the hay and straw standards, but a number of samples of straw from the central West were obtained and separated in order to study the problem of chaffiness. The hay-inspection service was continued on about the same basis as in 1937.

THE SOYBEAN INDUSTRY

A 15-percent increase was recorded in the number of inspections of beans, peas, and soybeans. Application of the official standards for these commodities was studied in connection with the supervision of licensed inspectors, and the practicability of the standards in their present form was again verified. Oil and protein studies of soybeans are to be resumed as samples of the 1938 crop become available, to determine whether revisions are needed in the standards for this commodity.

A study of recent trends and the present economic status of soybeans in the United States revealed that the rapid growth in recent years of acreage, production, and crushings of soybeans has been due, in part at least, to unusual conditions prevailing during those years. The maintenance of prices in the face of increased production was the result of relatively small supplies of certain other commodities, particularly cottonseed, flaxseed, and lard. Consequently, further expansion of soybean production seems undesirable until there is greater certainty of sustained demand. Although industrial utilization of the soybean and its products has attracted widespread attention, the fact is that industrial demand still constitutes only a small part of the total demand for soybeans. The position of soybeans in American agriculture and industry is not yet clearly established. Much will depend on the extent to which research workers are successful in improving present uses and discovering new uses for soybeans.

VERIFIED SEEDS

New research studies were begun in the marketing of Grimm alfalfa seed to ascertain the form of varietal assurance the purchasers were given on this seed, and a survey was made of the kinds and volume of seed certified by State crop improvement associations or other certifying agencies. Studies were made of country-run timothy, Sudan grass, and other forage-crop seeds with a view to establishing an inspection service of country-run forage-crop seeds, and of records kept by seed shippers and dealers in connection with the seed verification service.

The Bureau was given additional responsibilities, also, in connection with the administration of the Federal Seed Act in cooperation with the Bureau of Plant Industry. These responsibilities included the checking of import records and the supervision of weighing and staining 197 large commercial lots comprising 4,800,000 pounds of imported alfalfa and red clover seed in accordance with the requirements of the Federal Seed Act and the regulations governing importations.

LIVESTOCK AND MEATS

Livestock producers are doing rather better than crop producers this year compared with last. Prices of livestock and livestock products have declined less than prices of crops, and a major item, feed, in the cost of production, has been relatively favorable to livestock producers. A slight expansion in the livestock industries during the past year is expected to carry further through the next 2 years.

The Bureau conducts an extensive market news service on livestock and meats, has developed grades for these commodities, and does much research in connection with special economic phases of the industry. The market news service covers the public livestock markets, wholesale meat markets, the Boston wool market, the direct marketing of hogs, and the direct and contract marketing of sheep and lambs. It was extended in the latter part of 1938 to livestock markets in southern Georgia, northern Florida, and eastern Alabama.

More than 606 million pounds of meats were graded by the Bureau in the many markets interested in selling and pricing meats on the basis of quality. This service was extended to five new sections—San Diego, Calif.; Topeka, Kans.; Dubuque, Iowa; Cincinnati, Ohio; and Memphis, Tenn. It was extended to nonfederally inspected plants at St. Louis where efficient meat inspection is maintained.

Tentative arrangements were made for the establishment of standards for hog carcasses with respect to degree of hardness at the request of producers in the Southern States where a large number of hogs that produce soft and oily carcasses are raised. This project is being conducted in cooperation with the Bureau of Animal Industry. After the establishment of grades it is planned to establish a grading service for hog carcasses with respect to degree of hardness. Revised live-hog and hog-carcass grading charts were prepared for use in connection with the quality of meat study and other work in connection with which live hogs and hog carcasses are graded by both the Bureau of Agricultural Economics and the Bureau of Animal Industry.

LIVESTOCK AUCTIONS

A study of community livestock auctions in Iowa was made in cooperation with the Iowa Agricultural Experiment Station and the Farm Credit Administration. It revealed that all the auctions in Iowa are privately owned. The investment in physical facilities ranges from less than $1,000 to more than $12,000. The business of the individual auctions studied ranged from less than $4,000 to more than $1,000,000 in 1936. Charges for selling livestock at most of the auctions studied are based on sales value. Three percent is the most common rate. Charges at a few auctions are on a per-head basis. Cattle and calves are sold in larger numbers than sheep and lambs. In 1936, farmers consigned 64 percent of the cattle, 73 percent of the hogs, and 84 percent of the sheep and lambs to auction. Other consignments were from dealers. Most of the slaughter livestock sold is purchased by dealers who resell to packers. Few packers have their own buyers at auctions.

About 80 percent of the auctions are provided with scales and most of the livestock is sold by weight. In 1936 about 84 percent of the livestock was delivered to the auctions by truck, and 92 percent was

removed by this means of transportation. The remainder was transported by rail. About two-thirds of the livestock was delivered to the auctions from within a radius of 25 miles. Veterinarians appointed by the Iowa State Department of Agriculture inspect all livestock consigned for sale in order to prevent the spread of animal diseases.

FOUR NATIONAL PACKERS

A study of livestock slaughter revealed that the four national packing concerns handled in their federally inspected plants 65 percent of the cattle, 71 of the calves, 52 of the hogs, and 80 percent of the sheep and lambs slaughtered under Federal inspection in the United States during the 5-year period 1933–37. Of the total slaughter (wholesale, retail, and farm), they handled 45 percent of the cattle, 43 of the calves, 33 of the hogs, and 65 percent of the sheep and lambs. This represented about 42 percent of the meat produced from all slaughter.

The proportion of the total federally inspected slaughter handled in plants operated by these packing companies since 1920 has decreased for cattle and increased for calves. It increased for hogs in 1933 but has remained unchanged since that year. The proportion of sheep and lambs slaughtered increased from 1921 to 1929 but has decreased since then. The four national packing concerns were operating 88 slaughtering plants at the end of 1937. All but six of these were under Federal inspection. Between 1930 and 1937 they purchased or built 30 slaughtering plants, but 12 of those acquired were closed, making a net gain of 18 during the period.

FACTORS AFFECTING SUPPLY

A study of factors affecting cattle-slaughter supplies and cattle numbers in the United States from 1900–1936 is nearing completion. It indicates that year-to-year changes in cattle slaughter are brought about largely by changes in cattle prices in relation to feed costs, with such circumstances as the severe droughts of 1934 and 1936 causing marked liquidation of cattle in those years; that year-to-year changes in calf slaughter are associated with changes in prices of milk cows in relation to prices of dairy products; and that changes in cattle numbers on farms result largely from changes in prices of cattle in relation to feed costs and prices of dairy products, with the comparative regularity of the cattle-number cycle largely dependent on the interrelationship between the number of cows and heifers on farms and the size of the annual calf crop.

A similar study of the factors affecting prices of meats and meat animals was begun.

DIRECT MARKETING

Continuing research has revealed that direct marketing of livestock is being more extensively used each year. Its growth is shown by the changes in the percentages of all slaughter livestock purchased direct by packers. Increases from 1936–37 were: Cattle from 20.5 to 22.5 percent; calves from 29.6 to 33.7; hogs from 48.1 to 48.6; and sheep and lambs from 27.8 to 32.9 percent. A study of the direct marketing of stocker and feeder livestock shows that during the past

few years probably one-half of the cattle purchased as feeder animals were bought at points other than public livestock markets. The proportion of the feeder sheep and lambs marketed in this way was probably even larger.

WOOL RESEARCH

Work on wool included standardization research, marketing studies, fiber research, shrinkage research, and educational activities. Much time and attention were concentrated on the shrinkage problem. Practical forms of the standards were prepared and distributed as heretofore, standard wedge strips were distributed, and experimental work was undertaken in attempting development of new forms of grease-wool-grade standards, related to types and grades of wool produced in respective States. Proposed revisions of the upper seven grades of the wool top standards, 80's to 50's, were submitted to the industry in the latter part of the year. These revisions would change the grades from a comparison to a measurement basis.

Studies were made of the marketing of wool through auction sales and assistance was given marketing officials, extension workers, and wool-growers' organizations and their memberships in matters related to marketing, in connection with the clip-sampling work in the wool producing States. Fiber-measurement work on grades of wool top, and photomicrographic work on grease wool grades were carried on, principally as related to wool standardization, for the determination of the fineness and the distribution of the various grades.

DAIRY AND POULTRY

Especial effort is being made to improve and broaden statistical and economic research and to contribute sound analyses in helping to solve problems in the dairy and poultry industries. The Bureau's dairy and poultry market news service and standardization programs also are being reappraised to this end. An important development last year was the revision of the butter grades. A new type of market information is being organized to meet the needs of the dairy and poultry industries for data regarding current movements of products into consumption.

Arrangements have been made at Chicago, for example, for the issue of weekly reports of sales of butter and eggs by a number of chain stores and milk distributors. Following completion of these arrangements, a broader report is contemplated, whereby reports from packers, chain store companies, cooperative marketing associations, and other agencies will furnish data weekly regarding quantities of butter and eggs moved into retail outlets.

More complete data are being obtained of motortruck receipts of dairy and poultry products in the markets. A new type of price information on poultry and eggs, the prices paid shippers, f. o. b. terminal markets, has been made available at several markets. This information is of value particularly to nearby producers since it represents the delivered prices they may expect to receive. Reports also are being issued periodically regarding production, stocks, sales, and prices of poultry and dairy products.

Manuscripts have been prepared for publication, dealing with world production and international trade in butter and eggs, and

the production and consumption of manufactured dairy products in the United States. Special studies were made last year in connection with the utilization of milk and the production of different manufactured dairy products, regional differences in ice-cream production, and changes in wage rates and output per wage earner in dairy-manufacturing plants.

Similarly, the Bureau's research in poultry and eggs has been redirected to develop the basis for an objective answer to certain important questions which constantly arise in connection with poultry outlook work and economic analyses. These questions include seasonal changes in prices, changes in the output of hatcheries, and the peaks and valleys in storage holdings of poultry and eggs.

CONFLICTING DAIRY LAWS

Federal agencies dealing with economic problems in the dairy industry have concluded that a fundamentally bad situation exists in the multiplicity of State laws and municipal ordinances that are in effect interstate trade barriers. Studying this situation, the Bureau has found that many cities and States limit the area from which cream or milk may come by restricting the area to which they will send inspectors or in which they will grant licenses or permits. In some cases barriers have been erected frankly to exclude or to hamper the sale of out-of-State dairy products; in others the barriers are disguised as sanitary laws and regulations.

A large body of information has been assembled by the Bureau on this subject for use by Federal and State agencies seeking to effect improvements in the interests of producers, distributors, and consumers. Three reports have been published dealing with milk legislation and regulations in New England. They describe the present status of milk inspection by States and towns in this area, milk inspection in health districts of Massachusetts, and local laws and regulations governing the production of grade B milk. Through the New England Research Council on Marketing and Food Supply, the Bureau is cooperating with the six New England agricultural experiment stations in an effort to develop better regulations by city, State, and Federal agencies, and to make more efficient the marketing of milk at country points and in cities.

A study is being made also of interregional competition in the dairy industry. A report on this situation affecting the Midwest has been made to the Agricultural Adjustment Administration. Similar research is under way in New England where individual records have been obtained on 1,225 farms in sample dairy areas. Supplementary farm-management data have been collected in New England and the Lakes States in connection with an inventory of soil resources, local transportation and marketing facilities, and a compilation of dairy production trends and prices.

FRUITS AND VEGETABLES

The production of fresh fruits and vegetables is a billion-dollar industry. A recent study by the Bureau revealed that the gross income from vegetable production alone during 1933–35 exceeded that from cotton and cottonseed by nearly 4 percent; grains, by 15; fruits and nuts, 58; tobacco, 238; sugar crops, 900; and all other crops com-

bined, by 105 percent. It exceeded slightly the gross income derived from the major classes of livestock except dairy products. Vegetables are produced in every State, but in the main the industry is concentrated in certain well-defined areas along the Atlantic seaboard, in the Gulf States, the Pacific Coast States, and certain areas in the North Central States.

Principal activities of the Bureau in the fruit and vegetable industries include the issuance of production estimates, the establishment of standard grades for use as a basis of marketing, the maintenance of inspection services for the certification of products as to grade at shipping points and terminal markets, and the maintenance of a Nation-wide market news service to inform producers of market supplies, demand, and prices. The Bureau has issued 79 standards for 55 different fresh fruits and vegetables. More than 500,000 cars, or carlot equivalents, of fruits and vegetables were inspected on the basis of these standards at shipping points and terminal markets during the past year.

PRICE-MAKING FACTORS

For several years the Bureau has been studying and analyzing the factors that affect the prices of fruits, potatoes, sweetpotatoes, and various truck crops for market. Basic data, such as estimates of acreages, production, and prices are in process of statistical revision, but in general it appears that changes in the crop-year average prices of most of the major fruits and vegetables are closely related with changes in production of the commodity and in the level of incomes of consumers. As to fruits, including citrus fruits, it appears that the upward trend in demand that characterized the period 1919–26 has not continued.

Studies reveal that in many instances producers receive less than one-half the prices paid by consumers for fruits and vegetables. Efforts are being made to reduce the price margin between producer and consumer. Information is much in demand on harvesting, grading, packing, shipping, and handling in the markets, and on prices by variety, grade, size, and price-making factors. Publications relating to these and other related topics to promote efficient marketing were prepared or published.

SPECIAL MARKETING STUDIES

Special marketing studies are yielding information of value to producers of specified crops. A recent study of market distribution and price spread of Louisiana strawberries is an example of this work. The strawberry study revealed that although there are 135 markets of 50,000 or more population that did not receive carlot shipments from Louisiana in 1938, most of these markets are near large cities where supplies are obtainable by motortruck. It was learned that about one-fifth of the carlot receipts in the large markets are redistributed by truck.

A project of widespread interest deals with the advertising of vegetables. This study was initiated as a result of requests by representatives of the vegetable and potato industries at a meeting held in July 1937. It is in three parts: (1) Analysis of selected cases of

consumer advertising of farm products; (2) the advertisability of specified vegetables from the standpoint of their marketing and production conditions; and (3) the relation between characteristics of demand for these commodities and the probable effects of advertising. Tentative findings of the first section, a case study of the effect of advertising on the prices and incomes received by producers of raisins, oranges, cranberries, and walnuts, indicate that advertising has had much less effect on the demand for these products than seems to have been popularly assumed. The second part of the study indicates that potatoes and a number of other vegetables have certain characteristics of production and marketing that make their adaptability to advertising questionable.

PERISHABLE COMMODITIES ACT

The Bureau administers the Perishable Agricultural Commodities Act which seeks to suppress unfair and fraudulent practices in the marketing of fresh fruits and vegetables by licensing members of the industry, and revoking licenses for cause. As of June 30, 19,788 commission merchants, dealers, and brokers were under license. Seven licenses were ordered revoked, and 19 were ordered suspended during the year. Forty-six were automatically suspended through failure of respondents to pay reparation awards.

Nearly 2,400 complaints of violations of the unfair conduct provisions of the act were made to the Bureau during the year. Amicable settlements of disputes were made in 745 cases through informal administrative action resulting in the payment of more than $303,000 to complainants. Formal action was necessary in only about 12 percent of the complaints. There were issued 341 formal orders, of which 246 required the payment of damages aggregating $87,414; the remainder provided for disciplinary action only or dismissal of the complaints.

The Bureau administers also the Standard Containers Act which authorizes the establishment of uniform specifications for baskets, boxes, and other containers used in the packaging of fresh fruits and vegetables. Periodical inspections are made of container manufacturing plants to assure compliance with the act. A forward step in the administration of the act was the publication of a pamphlet describing the essential features of the new dimensional method of testing containers, and containing schedules of standard specifications. This should make for greater uniformity in manufacturing practices, and possibly effect some reduction in the number of different styles of containers.

TOBACCO INSPECTION

The most significant development in the Bureau's tobacco-inspection service was the decision of the Circuit Court of Appeals in the Fourth Judicial District upholding fully the constitutionality of the Tobacco Inspection Act of 1935. If this decision is upheld by the Supreme Court, it will clear the way for expansion in this service and buttress the right of Congress to enact legislation giving the Secretary of Agriculture broad regulatory powers in the marketing of farm commodities that enter into interstate commerce.

There was a moderate expansion of the tobacco-inspection service notwithstanding the restraining effects of court orders applying to four tobacco markets, and for the first time mandatory inspections passed the 200-million-pound mark. Total mandatory inspections amounted to 208,234,141 pounds, an increase of approximately 42 percent over the preceding year. A portion of the increase was due to larger production in the types inspected. Two auction markets were designated under the act, bringing the total to 25.

One of the major phases of the problem of expanding tobacco inspection and market news services during the past 10 years has been to overcome the inertia of nearly a century of loose-leaf tobacco marketing without the aid of such information for the protection of the producers. The year was notable for the marked interest displayed by tobacco growers, particularly in the burley district of Kentucky and adjoining States. The problem now facing the Bureau is to develop trained personnel to meet increasing demands for service.

WAREHOUSE ACT

There was an increase during the past year in the number of warehousemen, samplers, inspectors, weighers, and graders licensed under the United States Warehouse Act. As of June 30 there were 1,017 licensed warehousemen and 2,486 licensed samplers, inspectors, weighers, and graders. Table 1 shows the increase in the licensing of warehouses for the storage of different commodities.

TABLE 1.—*Storage capacity of licensed warehouses on June 30, 1937 and 1938*

Commodity	June 30, 1937	June 30, 1938	Commodity	June 30, 1937	June 30, 1938
Cotton---bales	6,248,262	6,536,767	Sirup---gallons	26,000	55,000
Grain---bushels	72,586,900	131,186,870	Dried fruit---pounds	11,573,355	3,900,000
Wool---pounds	13,448,420	36,798,420	Canned foods---cases	1,938,230	4,612,730
Tobacco---do	184,366,000	164,481,000	Cold-packed fruit pounds	2,688,000	2,688,000
Nuts---do	14,635	14,635	Seeds---hundredweight	375,700	500,914
Broomcorn---bales	17,750	20,250	Cherries in brine pounds	3,168,000	5,928,000
Dry beans hundredweight	283,000	3,931,000			

A number of terminal elevators at Chicago and other terminal markets were licensed, and there was a fairly substantial increase in the licensing of grain elevators at country points. The increase in the licensing of wool warehouses was due largely to the Government loan program established early last spring. Wool warehousemen in the Texas producing area were licensed for the benefit of growers. The advantages of the Federal Warehouse Act were thus carried directly to the producers.

The increase in the licensing of canned-foods warehouses resulted from the licensing of several plants in western New York, and more particularly from the licensing of several large plants to take care of grapefruit juice production in the Rio Grande Valley. With a record crop of fresh fruit which the market could not absorb at prices satisfactory to the growers there was a substantial increase in the production of grapefruit juice. This juice had to be financed pending

sale in consumer markets. Arrangements were made to store a large part of it in federally licensed warehouses, which resulted in the growers securing money at very low interest rates. Warehouses were licensed to take care of approximately 1,800,000 cases of grapefruit juice alone.

LOWER INSURANCE RATES

The Missouri fire insurance rate-making bureau announced that it would extend a credit in insurance rates of 10 percent to all federally licensed cotton warehouses in Missouri for the storage of cotton. This credit applies both to the warehouses and their equipment and the cotton stored therein.

Effective May 1, 1936, the rate-making bureau for the various surety companies had announced a substantial reduction in rates on bonds written for warehousemen operating under the United States Warehouse Act. This reduction was granted because of the favorable experience the surety companies had with federally licensed warehouses. Effective June 17, 1938, the bureau announced another reduction. The effect of these reductions is shown in table 2.

TABLE 2.—*Insurance rates per thousand dollars on goods stored in federally licensed warehouses*

Amount of principal	Rate prior to May 1, 1936	Rate effective May 1, 1936	Rate effective June 17, 1938
First $10,000	$10	$10	$7.50
Next $15,000	10	5	3.75
Over $25,000	10	3	2.25

Two reductions in bond premium rates in 2 years' time for bonds written under the Federal Warehouse Act clearly suggest that the experience of bonding companies with these risks has been very favorable and the official rate-making bureau so indicated in making the reductions. In contrast to these reductions, rates in connection with bonds for certain other warehousing risks have been increased.

Toward the close of the year large elevator operators in both the St. Louis and Buffalo markets filed applications for licenses under the Warehouse Act.

MARKETING RESEARCH

Changes of far-reaching effect upon farmers have been made in the marketing system in recent years. New ways of preparing and processing foods have been developed, the chain of distribution from farm to home has been shortened by the elimination of some unnecessary links, public agencies have begun to attack the problem of waste and high cost of handling foods in metropolitan markets.

Outstanding has been the increasing use of the motortruck in transporting fresh products direct from farm to market, eliminating rehandling en route, and reducing costs of distribution. Concentration motortruck markets have been developed in some regions, func-

tioning as diversion points where products are assembled and redistributed over wide areas. Large city markets now receive about half their supply of fresh fruits and vegetables by motortruck.

There is increasing public interest in economic problems raised by the growth of large-scale processors and distributors handling agricultural products. Two reports on this subject were published: (1) The marketing of fruits and vegetables by chain stores in the Northeastern States; and (2) the growth of food corporations and the trend of earnings of such corporations. The chain-store study was made in cooperation with the New Jersey College of Agriculture. A third study under way (in cooperation with the University of Wisconsin) deals with the distribution of dairy products in Wisconsin and surrounding States. A start was made in studying, also, the special sales campaigns undertaken by chain stores to move temporary surpluses of perishable agricultural products.

Two important Bureau studies deal with marketing legislation: (1) A survey of Federal and State regulations affecting interstate trade in agricultural products; and (2) the codification of laws affecting the work of the Bureau of Agricultural Economics. A projected report on Federal-State legislation will summarize most of the important laws and regulations on such subjects as transportation, inspection of dairy products and other foods, food taxes, license fees, grades, standards, market requirements, and similar subjects. It will attempt to show in a general way the extent to which legislation in these fields may interfere with the free movement of agricultural products in interstate commerce and indicate the nature of the economic effects of such laws on farmers and consumers.

TERMINAL MARKETS

Much interest has been directed at the Bureau's studies dealing with improved market facilities and improved practices on wholesale markets handling fruits and vegetables and other perishable agricultural commodities. In several cases this interest is being followed by the preparation of detailed plans for reorganizing markets to make them serve the farmer and the general public better.

One completed study dealt with the market for fruits and vegetables in Kansas City. This was made in cooperation with the agricultural colleges of Missouri and Kansas. The conclusions stated in the published report, the Wholesale Fruit and Vegetable Market in Kansas City, pointed out possible improvements that would lead to substantial reduction in costs by eliminating a number of unsatisfactory features in the present market.

The new arrangement worked out at Kansas City should (1) eliminate the necessity of hauling produce from the railroads to the market, thus saving about $150,000 a year in cartage in addition to eliminating the handling and reducing spoilage; (2) provide farmers with an adequate space for selling their produce, eliminating the present interference between farmers and dealers; (3) eliminate all traffic congestion; (4) establish a market that can be satisfactorily regulated and in which it will be possible to get accurate information on receipts; (5) give much better facilities for handling and

protecting produce; and (6) indicate places where expansion can be made to take care of needs for many years to come.

Although the new market is not yet under construction, leases have been signed for 58 of the stores and 250 of the farmers' stalls. Arrangements have been worked out with the railroads for handling of cars, all necessary blueprints and specifications have been drawn up, and financing arrangements have been virtually completed.

WHOLESALE MARKETS

Information was collected on the wholesale fruit and vegetable markets in 40 large cities. The data were summarized and released as Department Circular No. 463 entitled, "Wholesale Markets for Fruits and Vegetables in 40 Cities." This circular has had wide circulation, has been commented upon favorably by many newspapers and trade organizations, and has stimulated interest in the problem of improving efficiency in marketing fruits and vegetables.

In cooperation with the State Department of Agriculture and the State Agricultural College in Georgia, a study was made of the Atlanta market, which not only serves the city of Atlanta, but has become a concentration and distribution point for fruits and vegetables over a wide area. The Bureau has been asked by the Governor of the State to take the responsibility for approving any plans, before they are put into effect for relocating and combining all the existing wholesale markets operating in Atlanta. Work on the new market will go forward when financing plans have been completed.

In connection with a study of the Philadelphia market, on which a report was issued in December 1936, the Bureau has cooperated with the extension service in informing the members of the trade, farmers, and the railroads as to the conclusions of this report. A farm organization has been set up for each county and State in the vicinity of Philadelphia and these have been coordinated into a regional organization whose purpose is to get definite action in improving conditions in Philadelphia. If the suggestions made by the Bureau are carried out, there will be an annual saving of approximately half a million dollars, in cartage alone, in the distribution of fruits and vegetables in Philadelphia.

A study of market needs of the Southeastern States was recently initiated by the Bureau in cooperation with the agricultural colleges of North Carolina, South Carolina, Georgia, Florida, and Alabama. The general purpose is to determine how many markets are needed, where they should be located, how they should be laid out and operated.

MARKETING COSTS

Results of the Bureau's studies in the field of market organization, facilities, and practices have indicated many concrete methods of reducing distribution costs and improved methods of handling. However, in all the work thus far, reliance has been put on the voluntary cooperation of the various interests for effecting the necessary changes.

Studies of the spread between prices received by farmers and prices paid by city consumers for foods have been continued. A report issued in July 1936 summarized price spreads for 58 of the most important food products. This material has been kept up to date by several statistical supplements. These studies have been of interest and value in giving an estimate of the current marketing bill and in indicating general trends in marketing costs. The subject matter was recently used extensively in a report by the International Institute of Agriculture, entitled, "Investigations into the Margin Between Producers' and Consumers' Prices of Certain Foodstuffs."

For sale by the Superintendent of Documents, Washington, D. C. - - - - - Price 10 cents

REPORT OF THE CHIEF OF THE BUREAU OF AGRICULTURAL ENGINEERING, 1938

United States Department of Agriculture,
Bureau of Agricultural Engineering,
Washington, D. C., October 6, 1938.

Hon. Henry A. Wallace,
Secretary of Agriculture.

Dear Mr. Secretary: I submit herewith the report of the Bureau of Agricultural Engineering for the fiscal year ended June 30, 1938.

Sincerely yours,

S. H. McCrory, *Chief.*

INTRODUCTION

There is strong emphasis on the note of conservation in the work of this Bureau—conservation of crops through better harvesting and through adapting harvesting equipment to new uses of crops; conservation of land already in farms through better drainage and improved drain tile; conservation of water, which in some regions is more valuable than the land itself, through underground storage and more accurate and economical irrigation practices; and conservation of harvested crops through improvements in storages.

Preventing waste of what already has been grown makes the farmer a more efficient producer. Examples of improvements that promise savings at the finish line are to be found in improved harvesters such as those now being developed for sugar beets and sweetpotatoes; better storage for potatoes; new knowledge of requirements for storage of wheat and corn; and improvements in methods of ginning cotton. In the same category might be included the studies now being made of mechanical equipment for spraying and dusting crops for the control of insects and diseases.

Some new facts developed by these studies are in brief:

Low moisture content is the most essential requirement for the safe storage of wheat.

In humid areas artificial drying of wheat is probably more practical than ventilation.

Corn should be allowed to dry as much as possible in the field since the ears lose moisture faster there than in the crib.

A narrow corncrib is most effective in drying corn. Full slatted cribs are desirable for obtaining quick drying. Special ventilators are of little help in drying.

Alfalfa and grass silage, which are rapidly gaining in favor, produce higher wall pressures than corn silage and specifications are being developed for safe storage for these feeds.

Tests of tillage methods on one type of soil in the Cotton Belt show that the more compact the soil the lower the yield. Better yields are obtained with fewer operations. Indications are that similar results might be obtained on other soils and with other crops.

Tests of adaptability of different kinds of corn to machine picking show that some varieties may be picked with much smaller field losses than others. Under favorable conditions field losses in some cases have been under 2 percent.

In the effort to make pyrethrum growing profitable in this country sufficient progress has now been made on experimental harvesting machines to make a commercial harvester feasible.

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Efforts to cheapen costs of production of sweetpotatoes for starch manufacture have resulted in accessory equipment to remove vines from the path of the digger. Alterations have been made in potato diggers to adapt them to this crop in starch-factory areas where damage from bruising and cutting is of minor importance.

Work on wheelbarrow sprayers for applying insecticides to sweet corn and other crops, of particular importance in controlling corn borer infestation, has brought such promising results that the improved sprayers are now being put on the market. The same result has been attained with a wheelbarrow duster.

Cotton-drying equipment developed by Bureau engineers and covered by public patents was in use in 539 gins in the ginning season of 1937–38. Progress has been made in developing driers for smaller gins where low first cost and economical operation are essential.

Many cotton ginners have adopted improved saws recommended by the United States Cotton Ginning Laboratories. These saws, having finer teeth than those commonly used, obtain for the farmer approximately 20 more bales of ginned lint from each 1,000 bales of seed cotton.

Rehabilitation of large acreages of drained land already in farms in some of the country's best farming regions has been brought about through the public ditch-maintenance work of more than 40 Civilian Conservation Corps drainage camps under technical supervision of the Bureau. More than 2,500,000 acres of first-quality land has been benefited by this work.

Rapidly developing new practices in the supplemental irrigation of high-value crops in the humid section are proving profitable as insurance against short periods of dry weather and in keeping up the vigor of plants, such as strawberries, that carry over from one year to the next.

Recent results are also showing ways of lengthening the life of concrete silos through increasing the resistance of concrete to silage acids.

DIVISION OF FARM STRUCTURES

A survey made by this Bureau in cooperation with the agricultural colleges of Georgia, Illinois, Kansas, and Wisconsin showed that in the small areas covered the average amount spent for improvement of farm buildings during 1936 ranged from $100 per farm in one township in Illinois to 87 cents per farm in a Georgia district where much less building was done in 1936 than in the preceding 2 years. The amounts of repair and new building in these sections were not sufficient to cover current depreciation, and no headway was being made on the repair needs that had accumulated over several years of low income.

FARM BUILDING-PLAN EXCHANGE

The Bureau is continuing its efforts to get information leading to good selection of farm building plans into the hands of farm people and rural contractors, mechanics, and material dealers, the latter being important sources of information on planning and construction.

Selections were made of designs for farmhouses and other farm buildings for the Western States through cooperation between the Bureau, the Extension Service of the Department, and the offices of cooperative extension work in Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. A plan book containing designs for a great variety of structures which were selected by representatives of the colleges as best adapted for general use in the region will be available early in 1939 and will be for sale by the Government Printing Office. Working drawings are supplied by the extension services in the various States. Similar plan services have been in operation in the Middle West for 4 years and in the Northeastern States for 1 year.

Selection of plans to be included in a plan book for the Southern States, now in preparation, was made through field cooperation between the Extension Service, and the offices of cooperative extension work in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Texas, Tennessee, and Virginia.

In cooperation with the University of Wisconsin and 11 farm owners, studies of remodeling and improvement of farmhouses were continued. Eight have been rearranged, refinished, insulated, equipped with modern heating, plumbing, and lighting, or otherwise improved. Before these improvements were begun careful records were made of temperature and draft conditions in cold weather, of the time required for housework and of the general usability of the dwelling. Similar studies of the improved houses, together with before-and-after photographs, show what has been accomplished for the money and labor.

A somewhat similar study of farmhouses is under way at Athens, Ga., in cooperation with the University of Georgia, the tests being made in houses specially constructed for the purpose. Six one-room and two three-room houses represent various types of construction, some of which are new. The three-room houses are so built that ceiling height, window size and location, and other features can be changed from time to time for testing. Cottonseed hulls, fireproofed by a simple process that could be used on the farm, were used for insulation in some of these houses.

The Georgia tests indicate that in summer the differences in comfort appear to be mainly due to differences in amounts of heat radiated from warm or cool walls and ceilings. Air infiltration through walls, floors, roof, windows, and doors seems to lower temperature in winter more than is commonly supposed. Temperatures under an insulated flat roof were about the same as in a house with an uninsulated pitched roof. Small ventilators such as are used in the gables of a pitched roof failed to lower room temperatures appreciably in summer.

BUILDINGS FOR FARM PRODUCTS

The setting up of the ever-normal granary with provisions for farm storage of wheat and corn has placed on the Department the necessity of setting up minimum requirements for safe storage of these crops that will protect the Government against loss from depreciation without placing an undue hardship on farmers. These requirements cover condition of the grain when it is stored and the design and maintenance of storage buildings. To meet this need for additional information the Bureau is making studies of farm storage of wheat and corn. Information developed in these studies was utilized in preparing the Agricultural Adjustment Administration bulletins, Wheat Storage in the Ever-Normal Granary and Corn Storage in the Ever-Normal Granary, which outline storage requirements, and illustrate types of acceptable and undesirable storage buildings.

The study of farm storage of wheat is being conducted in cooperation with the Bureaus of Plant Industry and Agricultural Economics and the State experiment stations of Illinois, Kansas, Maryland, and North Dakota. These studies emphasize that under typical storage temperatures low moisture content is the most essential requirement for the safe storage of wheat.

Deterioration of wheat may be retarded by any means that lowers the moisture content or the temperature. Ventilation, shading, and storage underground retard deterioration, but have limited usefulness.

Experiments with many types of construction indicate that insulated walls are of limited value in retarding the deterioration of wheat during warm weather. Insulation of walls and floors may be desirable to retard concentration of moisture in cold parts of bins.

At Hays, Kans., and Fargo, N. Dak., where atmospheric humidity is relatively low, the better types of ventilation removed moisture at satisfactory rates and can be expected to dry moderately damp grain to safe moisture content before spoilage occurs. However, in these dry areas dependence should be placed on harvesting grain only when dry rather than on ventilating equipment.

At Urbana, Ill., and College Park, Md., thorough ventilation of masses of damp wheat prevented rise in temperature due to respiration and mold activity. However, deterioration continued slowly because little moisture was removed on account of high atmospheric humidity. The inconvenience and cost of installing ventilating flues, their relative inefficiency, and disadvantages when grain is to be fumigated, indicate that in humid areas artificial drying of wheat is probably more practical than ventilation methods.

Because of need for drying grain in the eastern areas where harvesting conditions are often unfavorable and ventilation is not effective, considerable attention has been given to artificial drying. Three experimental drying units have been built using the principle of raising interior vapor pressure of the wheat

by direct heating. These driers differ from commercial types in that the wheat is heated by direct contact with a hot surface prior to drying by an air blast. Heating is accomplished in about a minute and the total drying process requires less than 10 minutes. A portable experimental unit now under test at Arlington Experiment Farm, near Washington, D. C., has removed 2 percent of moisture at the rate of 90 bushels per hour. Changes now being made are expected to increase efficiency.

Studies of the storage of corn and the factors that affect drying were made in cooperation with the Bureau of Agricultural Economics, Bureau of Plant Industry, and the experiment stations of Illinois and Iowa.

In Illinois, use was made of 11 three-hundred-bushel cribs mounted on wheels on a small railroad track so they could be run over scales and weighed once a week. In addition, 75 ears were hung in a shelter where they were protected from sun and rain but otherwise fully exposed to the air and these were weighed two or three times a week. Every 2 weeks four of the ears were shelled and the moisture content of corn and cob determined. The corn used in these experiments was not so dry as the normal crop, the moisture content of the kernels being 26 to 28 percent at time of storage, and of the cobs about 50 percent. The ears in the shelter lost almost 20 percent of their original weight in 2 weeks while similar corn placed in the 300-bushel cribs lost only from 2 to 4½ percent of its original weight in the same time. This emphasizes the importance of allowing corn to dry as much as possible before it is placed in the crib, for even though the ears are covered by husks, they will dry much faster on the stalk than in the crib. The loss of weight in the cribs was of course affected by the amount of ventilation provided. Three of the cribs compared were 8 feet wide, 10 feet high, and 10 feet long. One had slatted sides the full height of the corn, in another the walls were slatted half way up, and the third was slatted only one-fourth of the way up.

During the early part of the storage season the crib with the sides slatted the full height lost nearly twice as much moisture as the crib slatted for one-fourth the height and lost 60 percent more moisture than the crib with only the lower half of the walls slatted. When the cribs were unloaded toward the end of March the crib with the full slatted walls had lost 2,340 pounds, the crib with the walls half slatted had lost 1,805 pounds, and the cribs with the walls slatted one-fourth the distance had lost 1,594 pounds. Another crib with the sides slatted one-half the height but with an A-frame ventilator through the center lost 1,120 pounds the first month as compared to 900 pounds for the crib slatted half the height but having no A-frame.

When the cribs were emptied in March the crib with the A-frame had lost 2,012 pounds, as compared with 1,805 pounds lost by a similar crib without the A-frame. When the cribs were emptied, samples were taken from each quarter of the crib at various levels. In the crib which had only the lower one-fourth of the wall slatted, 15 percent of the corn in the lower half of the crib and 22 percent in the upper half was damaged. The average moisture content was 23.4 percent in the lower and 25.4 in the upper half of the crib. In the crib with half the wall slatted, 9 percent in the lower half and 14 in the upper half was damaged. The corresponding moisture contents were 21.9 and 22.8 percent. In the crib with the wall slatted the full height, 10 percent of the corn in the lower half and 5 in the upper half was damaged, and the moisture contents were 22.5 percent in the lower and 20.6 in the upper half. The difference between the lower and upper half probably was due chiefly to the accumulation of shelled corn in the lower part of the crib.

In Iowa a large, double crib with bins above the driveway was used for storage experiments. Each side of the crib was divided into sections and on some of these sections tight siding was applied on part of the wall. The crib provided widths of 10, 8½, and 6 feet and was remodeled to provide varying amounts of ventilation. The corn at time of storage contained about 20 percent of moisture and was well-matured and sound. Seven of the crib sections were unloaded in June. In sections of the crib slatted for the full height the moisture content in the half of the crib next the driveway had dropped to about 16 percent, while that in the half of the crib next the outside wall had dropped to about 14. This was true on both the north and the south sides of the driveway. This suggests that more attention should be given to ventilation of the driveway space, and that when width and other factors are equal, single cribs should dry corn much more satisfactorily than double cribs. In sections of the crib which had part of the outer wall covered with tight sheathing the

moisture content was 1 to 2 percent higher than in sections where the walls were slatted.

The best drying was obtained in the 6-foot-wide section of the crib with the 8½-foot section next in order. The use of A-frame ventilators did not aid drying as much as did reducing the width of the crib. Mold damage occurred chiefly where shelled corn had accumulated and there was relatively little in other parts of the crib. This was probably due in considerable part to the good condition of the corn at time of storage.

POTATO STORAGE

Results of studies on potato storage in Maine, previously reported, developed more logical construction and management practices for potato storage in the colder sections of the country. The recommended types of construction are being adopted by owners of storages. Similar studies are now being made in Michigan in cooperation with the State agricultural experiment station. In general those practices recommended for Maine have been found effective for the varieties and conditions in Michigan. This year's work is emphasizing studies of injuries during handling.

NEW SILO PROBLEMS

The increasing practice of storing alfalfa and grass crops as silage has emphasized the need for information to aid in handling such crops. To provide a basis for safe silo design in accordance with the use to which the silo is to be put, the Bureau is making studies of pressures exerted by various types of silage and has developed special equipment for measuring the lateral and vertical pressures. The horizontal pressures exerted by corn silage were found to be somewhat below the accepted figure of 11 pounds per square foot per foot of depth, but with hay and molasses horizontal pressures averaged 19 pounds per square foot per foot of depth, and sometimes went as high as 22.

REFRIGERATOR-CAR STUDIES

Further studies of iced refrigerator cars of oranges in transit, made in cooperation with the Bureau of Plant Industry, indicate the rate of circulation of air depends largely on the temperature difference between the fruit and the air in the ice bunkers and to a lesser extent on the daily temperature cycle and the method of icing. The method of icing, however, does influence the average temperature of the air in the bunkers. For example, a half bunker of ice is much more effective if it is supported in the upper part of the car than if in the lower part because the air is cooled as soon as it enters the bunker instead of after it has descended halfway to the bottom.

ORCHARD HEATING

The Bureau has devoted some time to the study of atomizing oil burners for use in protecting orchards against frost. Types of burners now in use emit objectionable amounts of smoke when burning low-grade oils. To be satisfactory the burners must be low in cost, utilize low-grade oils, operate with little attention, and burn with the least possible amount of smoke.

FARM FENCES

A study was made of the condition of farm fences and of fencing problems in several sections of the country and a bulletin on farm fencing was prepared. Observations in many States reveal that in general farm fences are in poor condition. Many new fences were built last year and this suggests that when funds are available one of the first expenditures for new improvements will be made for fences.

MECHANICAL COOLING OF MILK

A study was made of recent progress in mechanical cooling of milk on the farm and a farmers' bulletin was prepared to replace an older publication on this subject. The study shows that during the past 5 years many improvements have been made in mechanical milk-cooling equipment. The cost has been reduced as much as 50 percent for small outfits and the increase in rural power lines has brought a greater use of automatic electric outfits.

DIVISION OF DRAINAGE

Rehabilitating and maintaining existing land-drainage systems through work of C. C. C. camps on public ditches was an outstanding activity during the year. These drainage improvements to increase the efficiency of farming operations were limited to highly fertile lands on which drainage had deteriorated because of neglect of outlet facilities during the period of agricultural depression. Tile manufacturers report greater demands for small agricultural tile, indicating farmers are taking advantage of the public improvements made by the camps. Assistance furnished the camps by cooperative drainage organizations amounted to more than $1,000,000. The projects benefited 2,600,000 acres of land and the commercial value of the rehabilitation work is estimated at $5,385,000. Applications from officials of drainage districts for assistance on maintenance projects greatly exceeded the capacity of the camps.

Supplemental irrigation in the eastern half of the United States increased as a result of rapidly developing new practices which are proving profitable particularly on truck and small fruit crops.

Continued research into cement qualities, concrete mixing and curing methods, and the use of admixtures is developing ways to make concretes highly resistant to destructive alkali and acid conditions found in the soils and ground waters of the Middle West and West.

HYDRAULIC STUDIES

The studies on the control of water at dams, chutes, spillways, and drainage outlets used in land-drainage, irrigation, soil-erosion, flood-control, and power-development projects have been continued in cooperation with the University of Iowa. Uncontrolled water flowing with high velocity often causes failures through continued erosion and undermining at the base of stream-control works. The utilization of the hydraulic jump, whereby a stream of high velocity and shallow depth is given low velocity and greater depth, offers a means of preventing structural failures. The principal difficulties lie in controlling the occurrence of the jump within limits of distance below the spillway or waterfall that will permit adequate and feasible channel protection.

Mathematical expressions for the location of the beginning of the hydraulic jump with respect to the toe of sloping aprons have been developed in terms of variable quantities and conditions of flow. These are based on results obtained on experiments with a model flume. Further analysis of the data obtained will be made during the next year to express the relationships on a rational basis applicable to structures of any size.

RUN-OFF INVESTIGATIONS

A comprehensive study was started of the run-off data collected on the Ralston Creek watershed area in Johnson County, Iowa, over a continuous period of 13 years. The purpose of this work is to develop relationships between effective precipitation and consequent rates and amounts of run-off.

The studies show run-off is not a uniform percentage of the precipitation that causes it, but is rather a residual after interception, evaporation, transpiration, and deep percolation have taken various portions. The amount of these losses is influenced by such conditions as air temperature, wind, humidity, vegetation, soil character, and topography, and the effects of these factors have not been generally determined. The investigations include ground-water well installations for observing water-level fluctuations to reveal the effect of drainage upon the maintenance and stabilization of ground-water and stream-discharge quantities. The hydrologic cycle is intricate, and the problem of scientific approach and analysis is much more than a simple study of water movements under particular conditions.

DRAINAGE OF TIMBERLANDS

Soil-water studies to ascertain the water-storage capacity of the northern Minnesota marshes and the effects, if any, of drainage on maintenance and stabilization of lake levels and stream flow and upon the growth of black spruce and tamarack continued in cooperation with the Minnesota Department of Conservation and the University of Minnesota.

The levels of soil water during 3 years of wide variations in climatic conditions clearly show close correlation between height of water in the swamps and precipitation quantities, for during the wet seasons ground water rose to high levels and in the dry periods the ground water receded. Records so far compiled show the water-storage capacity of these marshes can be calculated in advance of spring floods on the basis of available unsaturated top depth during November and December.

DURABILITY OF DRAIN TILE

Experimental work continued under cooperative agreements with the University of Minnesota and the Minnesota Department of Conservation to develop methods of making concrete drain tile resistant to soil alkalies, soil acids, and frost. So far tests have covered 158 brands of Portland cement from 103 mills of the United States, Canada, and Europe.

Since this comprehensive research study was started in 1920 many hundred thousands of speciments have been exposed to solutions of magnesium sulphate and sodium sulphate in the university laboratory and in Medicine Lake, S. Dak., the waters of which contain about 14 percent of sulphate and are so corrosive that nonresistant concretes submerged in them are completely disintegrated within a few months.

In the more recent experimental work some 20 different admixtures have been used, such as linseed oil, soybean oil, tung oil, and various siliceous and aluminous materials. Five-year tests of earlier specimens containing some of these admixtures displayed enough increased resistance to warrant continuing and extending the experiments, although results generally with admixtures have not been very encouraging. A large part of the time spent on this project during the year had to do with cylinders made during 1935 and 1936. Three-year tests of 100 different cements exposed in the laboratory to 1-percent solutions of both sodium sulphate (Na_2SO_4) and magnesium sulphate ($MgSO_4$) and in Medicine Lake indicate cements low in aluminum oxide (Al_2O_3) generally are resistant to deteriorative action of sulphate conditions and that cements high in aluminum oxide show low resistance to similar conditions. The same statement also is true with respect to the calculated compound tricalcium aluminate (3 CaO, Al_2O_3), frequently referred to by the abbreviation C_3A. This work has clearly shown that under the conditions of exposure represented by these tests, concrete made of a highly resistant portland cement may last 10 or more times as long as that made of a cement of low resistance.

When the work was started to determine causes of the numerous failures of concrete tile in use but a short time in public ditches of southwestern Minnesota and northern Iowa for land-drainage outlet purposes, Minnesota alone had constructed nearly 6,000 miles of large tile outlets for which expenditures amounted to approximately $6,000,000. Losses through the use of poor-quality cements had reached high figures and were direct losses to individual farmers taxed for the expensive drainage installations. Such failures have practically been eliminated where Bureau engineers have been consulted and tile-drainage works have been constructed in accordance with their recommendations. Many manufacturers have been induced to take steps to provide more durable cements and concrete products.

EFFECT OF SILAGE ACIDS ON CONCRETE SILOS

Many concrete silos have failed because of inferior quality of cements and the use of concrete mixtures low in strength and poor in resistance to silage acids. The cement studies at the University of Minnesota in 1937 included field examinations of some 200 concrete silos erected in Minnesota, Iowa, South Dakota, and Wisconsin. Results of permeability tests show that the transverse strength and density of silo staves are closely related. So far, it seems the greatest durability may be expected of those staves having transverse strengths upward from 140 pounds per inch of width when tested by applying the load midway between supports 24 inches apart. The amount of absorption of a stave in a 10-minute period following drying to constant weight at a temperature of 240° F. has been determined to be a direct measure of permeability. For strengths above 140 pounds per inch of width, the water absorbed in a 10-minute period under the above conditions is between 1 and 2 percent and is fairly constant. Limiting the maximum size of coarse aggregate to about three-eighths of an inch and controlling the mixture more exactly, increasing the quantity of cement in the

mix, and supplying improved tamping methods have been found the most dependable means of improving the quality of concrete silo staves.

IRRIGATION IN THE HUMID REGIONS

Recently developed sprinkling systems with revolving sprinklers mounted on lightweight portable pipe are now of great interest. The adaptability of these systems to different field conditions as well as their usefulness on all types of soil reduce the irrigator's problems. The cost of this type of equipment compares favorably with that of other types.

Incidental studies have shown that in humid regions there may be marked differences in the distribution of rainfall in places separated by not more than 50 miles. With proper knowledge of rainfall distribution in different localities the Bureau will be able to advise farmers with much greater assurance as to those areas where drought periods are too infrequent to make investment in irrigation equipment advisable.

Investigations at Willard, N. C., in cooperation with the agricultural experiment station of the University of North Carolina, the North Carolina Department of Agriculture, and the Bureau of Plant Industry, continue to indicate the desirability of irrigation for strawberries in that area. In spite of the fact that no irrigation was needed before or during fruiting last spring, which usually is the most important time, limited irrigation increased yield. Plots that had received irrigations to a total of 4 inches or more, 6 or more, or 8 or more yielded respectively 79, 172, and 227 quarts per acre more of marketable fruit than the average of four unirrigated plots. The difference in selling values were $9.66, $22.62, and $27.59. The best-irrigated plot, somewhat more heavily irrigated, produced 784 quarts of fruit with a selling value $104.61 greater than that of the checks. These increased yields from the irrigated plots are attributed to the beneficial effect of irrigating during the previous summer and autumn. This year's data also show that irrigations of less than one-half of an inch in depth were of little value. Yields from plots that received two or more of these light irrigations averaged little more, and in some cases actually less than from the unirrigated check plots. This was true even if water was applied by sprinkling systems or by the porous-hose method.

DRAINAGE OF SUGARCANE LANDS

The cooperators on the project for the study of drainage of sugarcane lands planted corn and beans on the entire area in 1937. Although these crops are not exactly adapted to cultural methods used in producing sugarcane, records were kept on the corn, to find out whether or not drainage improvements for sugarcane production materially affected the corn yields. The tile-drained areas produced 6.1 bushels more per acre and the open-ditch areas 5.2 more than check plots supplied with ordinary farm practice drainage. The average yield of the check plots was 11.8 bushels per acre. The four best tile-drained and four best open-ditch plots yielded respectively 26.7 and 22.9 bushels per acre.

The lateral distance to which drains affect ground water was about proportional to the depth of drainage. The influence of the deepest tile drains during the 1937 season extended out a much greater distance than did that of the shallow drains. Analysis of soil-moisture studies indicate wide variations in the character of the soil and its ability to retain moisture.

WATER CONTROL IN PEAT AND MUCK SOILS OF FLORIDA

The Everglades of southern Florida contains some 2,500,000 acres of peat soil of which 100,000 acres produce sugarcane, truck, and citrus crops. Drainage is essential to agriculture but the losses due to soil subsidence following drainage are such that optimum levels of the water table must be maintained to conserve the land.

For the past 5 years investigations have been carried on in cooperation with the State agricultural experiment station of the University of Florida at Belle Glade, on the relation of different water-table depths to subsidence and plant response. These investigations have revealed subsidence rates increase as the depth of the water table increases and to conserve the soil it is important to know the minimum depth at which the water level will permit optimum plant growth. Varying this depth between 1 and 3 feet has had little effect on the yields of sugarcane. Beans and cabbage grown on plots main-

tained with a water-table depth of 1 foot gave very poor yields and gave the best yields on plots with 18-inch depth to the water table. Good results would have been obtained for all crops so far grown on the plots with field water tables held between 1.5 and 2 feet.

The cost of pumping in drainage districts of the northern Everglades has been about $1.60 an acre and that of adequate maintenance of ditches and levees about $2 an acre, making a total drainage expenditure of $3.60 an acre for large areas. Seepage from undrained areas through underlying porous subsoil strata greatly increases pumping requirements. The 1937 records show that in four districts comprising 21,508 acres, about 37 inches of water was pumped from the land. The rainfall during the year was 58.4 inches. With water table held at 12 to 16 inches below the surface, test tanks growing cane or grasses or having bare soil gave the total annual evaporation, and transpiration from the cultivated peat soils of northern Everglades as averaging about 42 inches a year.

Experiments on the irrigation of sugarcane on the Everglades lands show little difference in yields from irrigated and nonirrigated plots. The average yield of cane per acre of all plots was 56.12 tons.

C. C. C. DRAINAGE CAMPS

Between July and December 1937, 7 of the 46 C. C. C. drainage camps operated by the Bureau were closed as a result of reduction in the C. C. C. program. The 39 camps remaining in operation at the close of the fiscal year were located as follows: Delaware, 2; Illinois, 5; Indiana, 6; Iowa, 5; Kentucky, 2; Louisiana, 5; Maryland, 3; Missouri, 4; and Ohio, 7. These camps have been repairing, renovating, or reconstructing existing drainage works of organized public drainage districts to improve health conditions, promote public welfare and convenience, provide better drainage for public highways, towns, and villages, as well as to serve agriculture. The camp projects are limited to improvements in good agricultural areas and no work is done that will drain artificial lakes and sloughs used by wild waterfowl or that will solely benefit private ditches, bring into cultivation additional lands, or improve lands better suited for other purposes than agriculture. Active cooperation is furnished by organized drainage or ditch districts or associations functioning in the original work, and these organizations agree to maintain the C. C. C. improvements for a minimum period of 5 years. The work projects are carried on to demonstrate recommended drainage-maintenance procedures for district organizations and to permit enrolled boys to obtain experience and training that will qualify them for gainful employment.

The outstanding achievement was the widespread interest and cooperation extended by local people. Organized drainage districts contributed more than $1,000,000 principally in labor, materials, and equipment, to assist in clearing 2,400 miles and reexcavating 1,800 miles of channels to adequate capacity, repairing over 75 miles of tile-drain outlets, and in building approximately 1,000 water-control structures. The best measure of the monetary value of this work is the estimated commercial value based on prevailing contract prices. On this basis the total commercial value was $5,385,000. Benefits to over 2,600,000 acres of land have assisted many farmers by relieving them of some of the burden of taxes for drainage maintenance.

Advanced engineering practices developed by Bureau engineers and effective procedures in organizing and carrying out maintenance work and in determining proper capacity and design of ditches are employed by the camps. For example, on March 30 and 31, 1938, Lebanon, Ind., had 3 to 4 inches of rainfall, causing flood stages approaching those of the disastrous 1913 flood. A field inspection of 10 rehabilitated drainage ditches during and following the rain showed that not a single ditch had been taxed to full capacity. There was no flooding of roads, nor were any bridges damaged on these projects. In contrast, nearby there was considerable flooding of farm lands and roads and damage to bridges and culverts caused by the flooding of ditches and natural waterways on which the camp had not worked.

MAINTENANCE OF DRAINAGE CHANNELS

Studies to develop improved drainage maintenance procedures was continued in cooperation with the C. C. C. drainage camps. Included in this is work on

clearing channels with heavy-duty mowers, mechanical weed-cutting devices attached to boats, hand labor, burning, and poisoning. Several reexcavated ditches were constructed with various side slopes and many of these slopes were seeded to different kinds of grasses to determine the best means of stabilizing channels. The most valuable accomplishment was the development of a truck-mounted scraper-excavator which does light clean-out work at about half the cost required when teams or tractors are used to draw scrapers. The machine consists of a gasoline-engine-driven double-drum hoisting unit mounted on a 1½-ton truck equipped with a 25-foot boom and scraper that can be extended over the ditch. It is adapted to work on small open ditches where the excavation exceeds that which can be done economically by hand labor and is not enough to justify operation of a standard dragline excavator.

FLOW OF WATER IN DRAINAGE CHANNELS

In connection with the C. C. C. drainage maintenance work, extensive research studies have been made to determine the effect of ditch maintenance on the velocity of flow and capacity of ditches. More than 1,900 field measurements have been obtained in ditches with bottom widths ranging from 2 to 123 feet and with water flowing at depths from only 1 or 2 feet up to bank-full stages. These measurements were made in 102 ditches representing a wide range of conditions of vegetative growth, soil types, cross-sectional shapes and areas in Delaware, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maryland, Missouri, and Ohio. The watershed areas of these selected ditches range from 150 acres to 80 square miles. The amounts and rates of run-off from approximately 55 watersheds also are being recorded to determine the basis on which drainage ditches should be designed as to capacity for different conditions.

Several of the selected slope courses were either cleared or reconstructed during the period of studies and it has been determined that for the same water depth, discharge capacities of ditches have in some cases been increased as much as two and one-half times by clearing and four times by clearing and reexcavating.

DIVISION OF IRRIGATION

At the close of the year the irrigation-water supply situation in the West was better than for several seasons. In some areas floods damaged crops and agricultural lands, but on the whole the excess precipitation was beneficial.

DUTY OF WATER

IRRIGATION OF SUBTROPICAL FRUIT

Studies of irrigation of subtropical fruit are being carried on in cooperation with the Bureau of Plant Industry near Pomona, Calif., to determine degrees of water deficit permissible without impairment to yield or quality of fruit. To establish permissible limits of moisture deficit more precisely, new plots were selected in 1937 on which the differences in water application are to be less than those used previously.

Broad flat-bottomed furrows 20 inches or more wide at the bottom have been adopted, the specific advantages of which are: Less erosion and undercutting of the sides, smoother bottom and less turbulent flow, advance of the water to the lower ends of the furrows in less time, wetting of a larger area and movement of the water into the soil more in the manner of rainfall, and less wick action at the sides. A cover crop can be started much more easily with these furrows than by methods previously used, and furrows can be placed closer to the trees with less danger of injury to roots.

At the start of the irrigation season in May 1938 trial plots were laid out with broad, shallow furrows in 18 orchards distributed over the area from San Fernando Valley to Fontana. As a result of these tests some further improvements were made in the furrowing machine. Development in furrowing methods has been well received by the growers, and it seems likely that the broad, flat-bottomed furrow will come into general use.

SYSTEMATIC ROTATIONS AND WATER REQUIREMENTS

In cooperation with the Bureau of Plant Industry, the Division has been carrying on a use-of-water study at the Yuma Field Station near Bard, Calif.

The primary object of the investigation is to obtain data on the consumptive use of water for field crops. In 1933 the original plans were changed to include field crops grown under practical farming conditions and to determine the depth of penetration of irrigation waters. These two main studies are now being carried out.

An investigation on the consumptive use of water for alfalfa was started. The main object of the experiment is to maintain the soil moisture at field capacity at all times. The results obtained from tank experiments at the Rubidoux Laboratory show high yields of alfalfa when soil moisture is maintained at field capacity.

The main reason for continuing the use of water studies is to obtain data prior to as well as after the completion of the All-American canal. These data will be of value to farmers and others when and if large areas of new land under the canal are opened for settlement.

During the first 4 years of the investigations, and prior to the storage of water behind Boulder Dam, varying quantities of silty water were used. During the past 2 years, following storage at the dam, the irrigation waters have been clearer and penetrated more readily into the subsoils. As a consequence, the use of water has increased. Wheat is now using 60 percent more water; barley, 18; corn, 12; citrus, 39; young alfalfa, 14; mature alfalfa, 25; and cotton, 10 percent.

SCOTTSBLUFF (NEBR.) STATION

At Scottsbluff, Nebr., also in cooperation with the Bureau of Plant Industry, irrigation activities were continued with but little change in operation over that of the past several years.

The moisture and water-use studies of corn and beans produced gratifying results. This may be said also of the results relating to effect of applying various quantities of water and the consequent crop yields. Encouraging results were obtained from the several methods of applying water on small grain. For potatoes it was found that close spacing of furrows as a means of supplying water does not seem satisfactory.

Results of experiments on irrigation of barley and young alfalfa by corrugations were very favorable. While irrigating grain by corrugations is not new, it has been practiced but little in the Scottsbluff section principally because of the rough topography. Only small streams (1 to 2½ second-feet) lend themselves to irrigation in such circumstances; therefore, uniform wetting of the soil by the method of flooding is most difficult. The roughened land surface resulting from the corrugations materially reduces wind erosion.

One year's moisture and water-use studies on beans and corn show that the period of maximum use by these crops extends from about July 15 to the latter part of August.

With alfalfa, the off-season use, as a two-plot average, covering the period September 1 to October 15, amounts to 5.77 inches. Taking these data and those found during 2 previous years, it is disclosed that the 3-year average of off-season use amounts to 3.78 inches. This, added to the 25.89 inches of use required for the production of three crops as previously determined, totals about 30 inches of water.

Water use by oats for this season amounted to 17.34 inches, which produced a crop of 56.1 bushels per acre. This use, averaged with that determined by 4 years of previous study, shows that oats used 14.81 inches, of which 64 percent was taken from the surface foot; 16 from the second; 12 from the third; and 8 percent from the fourth foot of depth.

With the work relating to methods of applying water the following results were obtained:

Corn showed yield increases up to more than 50 percent in favor of the application of water close to the row.

With potatoes, however, the results were not so encouraging. In only one of five plots were the yields under double-furrow irrigation better than those obtained by single furrows.

Alfalfa and barley irrigation plots showed the percentage of run-off was greater under furrow than flooding irrigation where the slope was about the same and in spite of the fact that a much smaller head of water was used in the furrows. The results with these crops indicate the probability that contour planting may have considerable merit as a means of getting water into the soil on the steeper lands. Seemingly the obstruction caused by the grain

plants at each 6-inch interval is effective in retarding surface flow and increasing the rate of absorption.

Tests of the effects of various irrigation treatments on beets and beans showed that the greatest application of water produced the largest yields while the smaller applications produced more per unit of water. Between these extremes there is a medium desirable to attain under irrigation farming. In this area it would seem that beans need about 14 to 16 inches and sugar beets 16 to 20 inches, in addition to rain.

IRRIGATION OF PEARS

At Medford, Oreg., the use-of-water studies have continued with particular attention to the irrigation of pear orchards. Progress during the current year has consisted principally in substantiating indications of previous years, with more detailed study being given factors relating to soil-moisture penetration through the use of inexpensive but sufficiently accurate methods of field soil-moisture determination.

Studies were initiated on the influence of differences in soil moisture on the amount of infection and rate of spread of pear blight. Other new studies were concerned with the influence of soil-moisture differences upon pear set of mature Anjou pear trees. In the project on application of experimental results to commercial orchard practice, a newly designed soil-moisture "availabilimeter" was used experimentally in about 40 separate orchard blocks representing about 15 soil types, and is being thus calibrated for differing conditions. The principal long-time objective is to determine moisture requirements of irrigated crops, especially pears, with due regard to climatic variations and environmental conditions; and to determine and put into practical form, irrigation methods concerned with time, amount, and method of application that will give farmers the best results.

SUPPLEMENTAL IRRIGATION IN THE DROUGHT AREA

In order to alleviate losses to stockmen in western South Dakota because of lack of winter feed in dry years, funds were made available through the Farm Security Administration for loans to farmers who wished to install irrigation systems. Acting in the capacity of technical advisor for the Farm Security Administration, the Division of Irrigation made a reconnaissance survey of the State to locate areas where irrigation might be carried on successfully. Several such areas were found, generally on river-bottom lands adjacent to the stream channels. The water may be delivered to the land by pumping directly from the stream, diversion by weirs or dams, pumping from wells, or by spreading the water from tributary creeks by means of levees or dikes. The areas are necessarily limited by the water supply and delivery costs.

Informal cooperation in studies of consumptive use of water and rainfall penetration was carried on with the city of Pasadena, Calif. Use of saline waters in irrigation of citrus trees was studied in cooperation with the San Dimas Water Co. and other agencies.

EVAPORATION FROM WATER SURFACES

Studies of evaporation in southern California have been conducted on a somewhat larger scale than heretofore, and new results obtained for both desert and coastal climatic conditions. Comparison of evaporation losses from a number of different pans is possible through continuous records obtained at the Baldwin Park, Fullerton, and Bard evaporation stations. The highest evaporation rate occurs under the desert conditions of the Bard area, and the lowest in the marine climate of the coastal plain. At the Fullerton station data are now available from a number of pans which have been maintained continuously since January 1935. The largest, 12 feet in diameter, has the lowest rate of evaporation, while the smallest, 1 foot in diameter, has the highest.

A new principle in evaporation investigations has been adopted. It consists in the use of a small shaded evaporation pan having a low rate of loss, approximately equal to that from the largest pan used. Satisfactory results have been obtained but further study is needed. A progress report is available.

Creation of Silver Lake in the Mojave Desert as a result of floods in Mojave River has produced an exceptional opportunity to study evaporation from a

lake surface under conditions of extreme temperature, at the same time testing the value of pan ratios. A station has been established there and continuous records of wind movement, pan and lake evaporation, humidity, and air and water temperatures are being obtained. Analysis of the records shows that evaporation varies from month to month and that the pan coefficients show seasonal variations.

SILT IN STREAMS AND RESERVOIRS

The silt program has been limited for some time chiefly to the determination of suspended silt in the principal streams of Texas. At present there are 12 sampling stations on 9 of the principal rivers. It is planned to extend the silt program to include surveys of small reservoirs.

DESIGN AND INVENTION OF APPARATUS

There is a steady increase in the number of installations of Parshall measuring flumes developed by the Bureau. During the past few months in the Poudre Valley, Colo., an irrigation system serving about 50,000 acres has completely equipped its distribution system with reinforced-concrete Parshall flumes. Several large flumes have been built recently in Colorado.

Recent developments of the riffle-type sand trap, both in the laboratory and the field, indicate the effectiveness of this new device in removing sand and gravel from irrigation canals. One of these sand traps has been built in the Arkansas Valley canal, near Pueblo, Colo., and limited experience shows it to be effective.

STORAGE OF WATER UNDERGROUND

Many of the original objects of the study of water spreading or storage of water underground have been accomplished and detailed results were published in Technical Bulletin 578, entitled "Spreading Water for Storage Underground." Certain problems relating to efficient spreading, however, remain to be solved. Among these is the determination of the length of time required to reestablish denuded areas by sowing native grasses or by other treatment.

The practicability of flushing out silt and debris from settling basins or ditches is still undetermined, although several existing systems were designed for it. An excellent opportunity to study the spreading system under flood conditions occurred in March 1938. Many of the spreading structures were damaged, owing mainly to inadequate diversion and protection works. Large quantities of debris were carried by the floodwater, and on those systems where provision had been made to control the debris the success or failure of the design was well demonstrated. The permanency of certain types of construction was also severely tested. The so-called "sausage dam" or "Pedley walls," which were developed locally and are in use on many of the spreading systems in southern California, proved to be satisfactory.

SNOW SURVEYS AND IRRIGATION-WATER SUPPLY FORECASTING

The 3 years that have elapsed since the project on snow-cover surveys and irrigation-water supply forecasting was launched by the Bureau throughout the 11 Western States have provided a background against which to view the value of the service. The undertaking has called for extensive cooperation in which several thousand individuals, many industrial concerns, and local governmental units assume a large share of the expense and work.

The forecasts are now looked on as a dependable basis for advance planning to control and utilize surface waters. Already, in every region throughout the 11 Western States covered by the surveys, the forecasts are being made with sufficient accuracy to justify the effort, and, in most cases where the work has been in progress for 5 or more years, the ultimate aim in accuracy is being realized. The Boise River drainage, Idaho, provides a good example. Here snow surveys have been carried on for 9 years. Before the spring freshets of 1938 the yield of the river for the current season was placed at 2,500,000 acre-feet of water—an abundant supply for all purposes and enough to make damaging floods probable. In view of this situation, the two irrigation storage reservoirs on this stream were operated to good effect as flood-control works. On May 15 the original forecast appeared to be highly accurate, the surplus water had been disposed of with minimum flood damage, and the greatest efficiency in water conservation had been effected.

Water shortages and droughts are characteristics of an arid region, and forewarning of such occurrences is about the only protection water users have against them. Bad droughts have occurred in the past, and they can reasonably be expected to occur again. In the light of such expectancy, people living in a semiarid or arid region should endeavor to become familiar with the characteristics of such situations, and to develop the necessary practices and methods of agriculture and water use.

The value of snow surveying as a basis for predicting water supplies has been amply demonstrated in Utah, Nevada, and California, and such surveys are now being carried on in all the other far Western States. The estimated total cost in Utah for the year 1937–38 is $4,000, or $0.003 per acre. Total costs to date have covered both actual field costs and cost of research.

Potential flood conditions as well as droughts are revealed by snow surveys. The winter of 1935–36 was one of heavy snowfall on the watersheds of northern and central Utah. The snow-cover measurements on April 1 indicated an exceptionally large quantity of water in snow storage. In addition to the heavy high snow cover there was an unusually heavy low snow cover of high density. These conditions constituted potential flood flow on many streams. Warnings were issued with the suggestion that stream channels be cleared if the damage from high spring run-off was to be minimized. On many streams such precautions were taken and the high water did little damage; on other streams no precautions were taken, and considerable damage occurred.

In the upper Rogue River Valley, Oreg., it was necessary to advise orchardists of probable irrigation supplies, in order that appropriate early-season orchard practices might be followed. Snow surveys have furnished basic facts upon which early season water forecasts have been issued since 1935 in this area, as shown in table 1.

TABLE 1.—*Forecasts issued on basis of facts ascertained in snow surveys*

Date of forecast	Forecasted total peak storage for 4 reservoirs	Peak storage	Error in forecast
	Acre-feet	*Acre-feet*	*Percent*
Apr. 1, 1935	33,100	32,200	+2.8
Apr. 3, 1936	37,200	40,000	−7.0
Apr. 5, 1937	40,700	40,980	−.7
Apr. 5, 1938	47,900	49,700	−3.6

Considerable attention was given the winter-sport informational service, made possible by the snow surveys, during the period December 15, 1937, to March 31, 1938. This service was popular, and there is a strong demand for its continuation and extension.

FLOW OF WATER IN CANALS

A manuscript entitled "Flow of Water in Irrigation and Similar Canals" was submitted for publication. This manuscript contains capacity data on types of lined and unlined canals and brings up to date all data gathered by the Bureau on the hydraulic characteristics of these many types. A study was started of the life and performance of materials of construction used in irrigation systems. Only in recent years have many of the more common materials had sufficient use to indicate their annual cost and upkeep needs. In many cases replacements have been made, but the costs have been borne by farmers or groups of farmers whose records are incomplete or not available.

CUSTOMS AND LAWS

The study of the present use of sewage as a supplemental water supply for irrigation was completed, and a bulletin on the subject is being prepared for publication. It was found that effluents from treatment plants, and in a few cases raw sewage, were being used to irrigate crops in more than 100 western communities. The practice is of economic importance in many areas and is generally subject to restrictive laws or regulations owing to the public-health implications, the standards imposed by public authority having become increasingly strict. The chief effect of the practice upon western agriculture has been

as a supplemental rather than a major water supply, and it is believed that further extensions will be principally in the field of adding to existing supplies of water in irrigated general-farming areas and in providing water for irrigating crops for winter feed for livestock in dry-farmed areas.

A study of State water laws, in cooperation with the Solicitor's Office, was begun and will be completed during the first part of the next fiscal year. This study is confined principally to the water laws of the 17 Western States. The purpose is to provide the Solicitor's Office with a legal basis for disposing of questions concerning water rights arising in connection with departmental programs and for making recommendations for desirable State legislation.

SERVICE WORK

Five men of the Division's personnel served as members of committees of the National Resources Committee in its planning of water development, use, and conservation in the several drainage basins of the West. Meetings were attended in several western cities, reports prepared, and outlines and estimates submitted for projects in which the Division had an interest.

A study by one member of the Division included a Works Progress Administration project concerning the water-table conditions in the lower Rio Grande Valley, and reports were prepared on the San Benito, Willacy, Donna, LaFeria, Pharr-San Juan, El Hardin, Mercedes, Harlingen, and Los Fresnos areas.

Two members served for a time as technical advisers to the Bureau of Plant Industry in the construction of an earth-fill dam at Woodward, Okla. Toward the close of the year one man was assigned to assist in flood-control studies in southwestern Oklahoma conducted for the War Department. One man assisted the Forest Service in its flood control watershed studies, authorized by the Flood Control Act of 1936, in the State of Washington, and two men assisted in similar work in California.

The manuscript of the regional planning report of the upper Rio Grande was completed and was subsequently published by the National Resources Committee.

DIVISION OF MECHANICAL EQUIPMENT

FERTILIZER-DISTRIBUTING MACHINERY

Improper placement of commercial fertilizer frequently resulting in early injurious effects on seeds and plants and a reduction in yield has been of increasing concern to farmers, implement and fertilizer manufacturers, and research workers. Extensive field studies in which the Bureau participated have shown that in practically all cases the crop return from the use of fertilizer depends to a considerable extent on the method of application. Under severe conditions, particularly inadequate soil moisture following the planting of seed or transplanting of seedlings, fertilizer improperly applied often causes sufficient early injury to make replanting necessary.

The Bureau is concerned with both the performance of fertilizer-distributing machines and fundamental information on fertilizer application obtained through field experiments with various crops.

The Bureau participated in 57 fertilizer-placement experiments at 34 locations in 13 States. The other agencies cooperating in these studies were the Federal Bureaus of Plant Industry and Chemistry and Soils; the North Carolina Department of Agriculture; the Virginia Truck Experiment Station; the Georgia Coastal Plain Experiment Station; the State experiment stations of Colorado, Delaware, Georgia, Indiana, Maryland, Michigan, Mississippi, New York (Ithaca and Geneva), North Carolina, Ohio, Pennsylvania, South Carolina; the National Joint Committee on Fertilizer Application; and the National Fertilizer Association. The experiments were conducted with more than 20 different crops.

The results of the past year substantiate those of previous years, which in general indicate for most of the crops studied that early injurious effects are avoided and the fertilizer is most effective when placed in a band about 2 inches to the side of the row and at a depth of about 3 inches in the soil. The most advantageous placement depends somewhat on the kind of crop, amount and kind of fertilizer, soil type, amount of soil moisture, and other conditions. For example, under the conditions of the experiments, placement of fertilizer either directly under the seed or only one-half inch to the side was most effective for sugar beets, while with sweetpotatoes a placement 5 inches to the side at a depth of 5 inches was among the most advantageous methods.

As examples of the influence of fertilizer placement on the crop, the following average yields obtained over a period of years are given for the two placements (1) band about 2 inches to each side and (2) mixed with the soil in a zone about 5 inches wide under the seed or plant: Snap beans (in pounds per acre), 3,214 side, 2,561 mixed; cotton (in pounds of seed cotton per acre), 1,103 side, 999 mixed; potatoes (in bushels per acre), 305 side, 276 mixed; and tobacco (in pounds per acre), 1,378 side, 1,213 mixed and (in dollar value per acre), 306 side, 259 mixed.

Improved fertilizer-depositing equipment has been developed and the more advantageous methods of fertilizer application have been adopted in farm practice to an appreciable extent, particularly for those crops on which field studies have been in progress several years. Manufacturers have endeavored to provide suitable equipment as soon as requirements were definitely known. Because it has been difficult to adapt similar depositors to machines varying widely in general design, in some instances the placement of fertilizer deviates somewhat from that indicated by the field studies.

A number of reports of striking advantages of the improved methods have come to the attention of the Bureau:

One cotton grower found it necessary to purchase three improved fertilizer depositors for his cotton planter during a period of two seasons because of excessive wear under the existing soil conditions, but he considered the new method of sufficient advantage to justify the unusual expense.

A State extension horticulturist recently made the following statement: "The method of applying fertilizer is of as much importance as the material itself. The band method (side placement) of fertilizer application for potatoes, peas, beans, sweet corn, and lima beans has become the standard practice from Maine to Florida and California." Whether or not side placement of fertilizer in farm practice has expanded to the extent indicated, a large number of growers have adopted the new method.

Figures on the number of recently improved fertilizer depositors obtained by growers are not available. As an indication of the demand, one of the smaller manufacturers reports that 2,000 side-placement depositors for one particular style of cotton planter were sold during 1937, the first year the equipment was offered for sale, and that the demand was greater during the 1938 season.

CORN-PRODUCTION MACHINERY

Corn-production machinery investigations were continued in cooperation with the Iowa Agricultural Experiment Station.

Results in 1937 show that in preparing a seedbed for surface-planted corn, fall plowing to 4-inch depth caused a yield increase of 5.8 bushels per acre; 8-inch fall plowing, 4.5 bushels per acre; blank basin listing in the fall, 1.5 bushels per acre; and chiseling 10 inches deep in the fall produced no benefit, all as compared to check plots simply disked and harrowed and which yielded 70.7 bushels per acre.

In comparison of different methods of secondary preparation after fall plowing the best yield, 74.4 bushels per acre, was obtained by using a tandem disk harrow and a spike-tooth harrow three times, April 23, May 7, and May 14. Where this combination of machines was used only once, May 14, the yield was reduced 4.8 bushels per acre. The poorest yield, 54.5 bushels per acre, was obtained on plots that received no secondary preparation except cultivating at the time of planting. On spring plowing, the best yield, 73.4 bushels per acre, was obtained by using the tandem disk harrow and spike-tooth harrow only once. Where these machines were used three times there was a slight yield reduction of 0.5 bushel per acre. Other methods that involved less work on the soil resulted in small yield reduction, the lowest yield being 65.9 bushels per acre.

In a machine-planted and cultivated comparison of row and hill spacings, the best yield, 82.9 bushels per acre, was obtained with single-plant hills spaced 21 inches apart each way. The usual spacing of 42 by 42 inches with four-plant hills yielded 75.3 bushels per acre; and two-plant hills spaced 30 by 30 inches yielded 81.2 bushels per acre.

In spacing experiments in cooperation with the farm-crops section of the Iowa Agricultural Experiment Station and the Bureau of Plant Industry where the corn was hand planted and hand cultivated it was found that three hybrids responded differently to the influence of spacing. With each, the standard 42- by 42-inch spacing with four-plant hills, yielded less than the best spacing of single-plant hills, but the optimum spacing of single-plant hills varied with the

different hybrids. Drill planting in 42-inch rows yielded from 2 to 5 percent less than 42- by 42-inch hill planting.

A machine-planted and machine-cultivated comparison of 42-inch hill and drill planting showed no significant difference in yield.

In a comparison of surface drill planting, listing, and basin listing, the yields were, respectively, 75.2, 61.5, and 53.1 bushels per acre on land plowed 8 inches deep the previous fall. Results of the previous 3 years had shown surface planting to yield better than listing but had shown no consistent difference in yield between listing and basin listing.

The different machines available for use in early cultivation of corn were compared in check-planted and also in drill-planted corn and on fall-plowed and spring-plowed land. The different machines used and the resulting average yields of corn in bushels per acre were as follows: Spike-tooth harrow, 67.0; spring-tooth weeder, 70.6; rotary hoe, 70.2; cultivator with rotary-hoe wheels near the rows and sweeps between rows, 70.0; check plots that received no early cultivation, 68.7. These results show that the work of the spike-tooth harrow was somewhat inferior. Omitting early cultivation caused only 1.3 bushels per acre reduction in yield below cultivated plots, which was not enough to be significant. These results practically agree with those of previous years.

Tests of different kinds of corn for adaptability to machine harvesting showed that field losses with hybrid No. 939 were less than half of those with Krug. In a test on October 28, the total field losses with hybrid No. 939 were 1.96 percent of the yield, while losses with Krug were 4.83 percent. Both of these records were unusually good. The same kinds of corn tested on November 26 showed total losses of 10.60 percent for hybrid No. 939 and 24.35 for Krug.

In a time study of harvesting corn with a two-row mounted picker it was found that, using a pick-up truck to tow wagons and cribbing the corn in a storage building equipped with inside elevator and dump pit, one man could haul, weigh, and crib the corn as fast as it was harvested by the picker in corn yielding 80 bushels per acre. The rate of harvesting was 1.8 acres, or 143 bushels, per hour.

When all of the work of picking, weighing, and cribbing was done by one man using a tractor-mounted picker and three wagons, the rate of work in corn yielding 60 bushels per acre was 1.2 acres, or 72.7 bushels per hour. This may be compared with the rate of work in hand husking which is usually 8 to 10 bushels per man-hour.

SUGAR-BEET PRODUCTION MACHINERY

Investigations of sugar-beet production machinery were continued in cooperation with the Colorado and California Experiment Stations.

Mechanical thinning of commercially planted beets has been done experimentally for several years, but the practical application was stimulated this year by the single-seed-ball planters built by Bureau engineers which place individual seed balls at regular intervals. An individual seed ball may contain several germs but a large percentage of the balls yield only single plants. This method of planting, therefore, has resulted in approximately 50 percent more individual plants than are now obtained from the clusters of seed balls dropped by the commercial planters. With more single plants it is more feasible to chop from the planted row at machined, regular intervals and expect single beets to remain in the uncut sections.

The mechanical beet harvester, heretofore tried in Colorado, had given evidence of commercial acceptability. The past year's trials in California under more severe conditions show the need for more development work. However, the progress made in mechanized thinning and harvesting has been sufficient to stimulate great interest in the possibilities.

COTTON-PRODUCTION MACHINERY

The sixth year's results of tests on machinery and methods for seedbed preparation, planting, and cultivation of cotton on Red Bay sandy loam in Alabama are in line with the previous results and show that tillage methods affect both yield and cost of production. Preliminary tests indicate that equally significant results would be obtained on other soil types. These investigations have been discontinued.

Studies made on the experimental plots during the 1937 crop season show methods of tillage have cumulative effects on the soil structure—some beneficial,

others detrimental. The data obtained show that the compactness of the soil in the row is closely related to yield, that is, the greater the compactness the lower the yield. An open aggregated soil structure with high moisture-holding capacity is most favorable for cotton production. Seedbeds prepared about 8 inches in depth approximately 60 days before planting (using either the moldboard plow followed with light bedding with the cultivator or using the middlebuster and the small plow to completely plow the row out and then plow it back to form a bed) produced the highest yield and permit an efficient labor distribution. Using several machine operations to produce a highly pulverized seedbed reduced the yield and increased the cost.

The studies of methods of turning under cover crops were continued. Cotton was raised on the plots during the 1937 growing season and corn was planted in 1938. In 1937, as before, the maximum yields were obtained on plots turned with large-base moldboard plows though the vertical, one-way disk plow may be most economical when the acreage handled per unit is considered. The results obtained during the 2 years this study has been carried on show clearly the value of 10-inch spacing between disks and high speeds for the vertical disk plow. This has resulted in manufacturers and farmers converting nearly every unit in the Montgomery territory from the standard 8-inch to the more favorable 10-inch spacing and in many cases to mount the plows on rubber tires.

Attempts have been made to adapt for the use of the small farmer certain improved tillage and planting methods and equipment. A large percentage of the small cotton farmers, because of the limitations of existing farm equipment and their small mules, are forced to plant their cotton under conditions unfavorable for early growth and cultivation. The common tendency is to plant in a trench made by a fertilizer distributor in the top of the bed. A few farmers use an extra operation per row to cover the fertilizer and to smooth off the top of the bed. In order to save this extra operation the planter is frequently run directly after the small fertilizer distributor, placing the seed in close contact with the fertilizer and in a trench often called a hog trough. Although this method of planting increases the probability that the cotton will have to be replanted few farmers have equipment that enables them to follow a better method. New methods of bed shaping and final cutting were studied. It was found that a simple attachment could be added to the conventional fertilizer distributor which, without an extra field operation, eliminated the troubles in the hog-trough system. The new attachment consists of two oval knives for refilling the fertilizer furrow and a V-shaped cutting blade to smooth the bed to a uniform surface. The use of the attachment was an aid to the first cultivation as the bed was of uniform shape and the trash, stones, and clods had been moved toward the row middle.

The rotary hoe under limited conditions in growing cotton on low beds and on land free of rock and trash was found to be a valuable implement for early cultivation and for breaking soil crusts so that young cotton plants could come up to a stand. Commercial rotary hoes, because of their size are impractical for the one-mule cotton farmer. A redesigned rotary hoe was constructed for one mule using two sets of five-hoe units with their centers a row width apart. Tests made with this implement indicated that the machine is effective for killing small weeds and for breaking soil crusts to aid young cotton plants.

TILLAGE-MACHINERY LABORATORY

Comparative-performance studies were made of moldboard-plow bottoms designed to meet different conditions in the United States. Performance characteristics were measured at different speeds and depths in different soil conditions. The tests, carried on at the Farm Tillage Machinery Laboratory, Auburn, Ala., show that the colter and the landside affect the draft and other reactions markedly in the two types of soil studied.

Preliminary indications of a study under way at the Farm Tillage Machinery Laboratory are that the angle of the moldboard to the direction of travel affects the draft, throw of the soil, and the quality of the work. Reducing this angle 4° on a stubble bottom lowered the draft 0.5 pound per square inch of furrow slice in a Davidson loam soil at 2 miles per hour and 1.24 pounds at 7 miles per hour without appreciably affecting the quality of work done. This represents an approximate saving in power from 13 to 20 percent.

Studies of disk-harrow blades held in a fixed position in the different soils at the laboratory have brought out certain variable force relationships. On

soils with a low colloid content and other soils with low moisture and in an uncemented state, the factor of draft increases rapidly with speed. In moist heavy clay soils there is a fluctuating relationship between draft and speed. At the low speeds the draft is relatively high because of the sticking of the soil to the disk. At intermediate speeds the adhesive power of the soil is broken down and there is a marked lowering of the draft due to the sliding of the soil over the disk surface. At the higher range of speeds the draft mounts as the forces set up tend to overcome the cohesive strength of the soil and throw it forcibly from the disk. The minimum speed that permits a uniform smooth flow of the soil over the disk without the need of the scraper gives the lowest draft figure. This emphasizes the importance of the development of more flexible-speed tractors on rubber tires. The free flow of soil over the disk seems to produce a condition favorable to a good yield of cotton.

Tests with disks free to move up and down in the soil, as is the case with the ordinary disk harrow, showed that in a sandy soil, for every degree increase in angle (range of study covered 14° to 30°) the plane of the disk makes with the line of travel, penetration of the disk is increased slightly more than 0.1 inch; that for every mile per hour increase in speed the disk penetration is reduced 0.2 inch; and that for every 10 pounds increase in weight imposed on a pair of opposed disks the penetration increases a little more than 0.1 inch. Draft per pair of opposed disks set at a 20° angle to the line of travel increased from 71 pounds at 1 mile per hour to 89 at 8 miles per hour. With disks set at 30° angle the draft for the same speeds was 142 and 229 pounds, respectively. The increase in draft was 25 percent for extreme speed change for 20° setting of disk and 61 percent for 30° setting.

HARVESTING AND DRYING PYRETHRUM

The salient features of a stripper for harvesting pyrethrum have been developed in cooperation with the Bureau of Plant Industry. They consist mainly of a pair of inclined fluted rollers, so mounted that the pyrethrum flowers are stripped from the plant as the machine is pulled forward astride the row. The flowers then fall on belt conveyors and are conducted to a box mounted at the rear of the machine. This machine performs creditably under field conditions existing in the East but may need altering if used in irrigated areas where more rank growth of the plant is encountered. As the principle of harvesting pyrethrum flowers has been successfully demonstrated, it should now be possible to manufacture machines for the purpose.

Studies of artificial drying of pyrethrum flowers are now under way, the main idea being to determine the maximum temperature that can be used without causing an appreciable loss of the pyrethrin content.

HARVESTING SWEETPOTATOES FOR STARCH

Because sweetpotatoes are easily injured mechanical harvesting for direct food use has proved impracticable, but mechanical injury is of little importance when they are to be used in the manufacture of starch. Use of a part of the crop for starch, and at a low price, necessitates the use of harvesting machinery. At present in certain sections of Mississippi, the man-hours and horse-hours for harvesting an acre are about half of that required for producing and harvesting the crop. Preliminary work was started in the development of sweetpotato-harvesting machinery during the 1937 harvest season at Laurel, Miss., in cooperation with the Bureau of Chemistry and Soils.

A vine-cutting and barring-off device was constructed for disposing of some of the vines ahead of the harvester and improvements were made on it this year. With the vines out of the way, an elevator-type potato digger, with some alterations, apparently meets requirements. A bunching or loading attachment is desirable for large-scale operations and changes have been made in an elevator-type digger, including a bunching attachment for leaving the potatoes in piles of from 3 to 5 bushels to facilitate loading.

PEST-CONTROL EQUIPMENT

Work on pest-control machinery had to do with the development of equipment for control of the European corn borer and the development and testing of equipment for control of pests of fruits and truck crops.

During the season of 1937 changes were made in the design of the self-aligning disk jointer to give the device greater strength. These changes were thought

necessary after some trouble was experienced with the earlier-designed jointers on heavy plows in southern Ohio under very severe soil conditions. Efforts to interest manufacturers in their production were continued. The self-aligning disk jointer in addition to its effectiveness as an aid to clean plowing for pest control has proved to be of great assistance in plowing heavy growths of cover crop and heavy layers of straw and crop residues left on fields by combine harvesters. Many cooperating farmers in Ohio are using the disk-jointer equipment successfully in conditions where they find it impossible to plow with conventional colter equipment. The inclined disk cuts through heavy trash much more effectively than does a straight colter blade.

The experimental vapor-spraying machine was used during 1937 in cooperative field tests with the Bureau of Entomology and Plant Quarantine and the Ohio Agricultural Experiment Station on apples, cherries, peaches, grapes, and celery. This sprayer is apparently more effective than the conventional hydraulic sprayer in applying fungicides and of about the same effectiveness in applying insecticides. The test work is being continued in 1938 in Ohio and Michigan.

In 1936 the entomologists working on corn borer insecticides desired a small wheelbarrow sprayer for applying insecticides to growing sweet corn. No commercial sprayer was available which could be pushed by hand through the loose soil of the average cornfield. During the past year a power-operated pump has been placed on the wheelbarrow sprayer. The outfit weighs approximately 225 pounds ready to operate and can easily be handled by one man.

A power wheelbarrow sprayer should be of considerable benefit to the small grower of vegetables and other crops. At the present time there are no power-operated sprayers on the market that can be used in a field without horses or other tractive power. As a result of the development work with wheelbarrow sprayers one manufacturer is putting a machine on the market this year.

For dusting sweet corn for corn borer control a ¾-horsepower duster was mounted on a wheelbarrow-type chassis and proved very satisfactory. This unit with pneumatic tire weighed approximately 135 pounds and was readily handled when dusting two rows of corn. Two of the wheelbarrow dusters are being used in applying dusts to corn and one has been prepared for use in dusting beans.

As a result of the development work on the wheelbarrow duster one of the duster manufacturers has a similar unit available at this time.

In cooperation with the Bureau of Entomology and Plant Quarantine considerable time was spent at Florala, Ala., in the preparation of burning equipment for use in the control of the white-fringed beetle. A mule-drawn burner was designed which used five commercial burner units.

Equipment was devised for burning crude sulphur for fumigation of greenhouses. Tests to show the effectiveness of this treatment have not yet been completed.

MACHINERY FOR WEED CONTROL

Investigations were started this year on machinery and methods for weed control. In October 1937, an engineer of the Bureau was detailed to Logan, Utah, for investigations in cooperation with the Utah Agricultural Experiment Station.

Preliminary investigations are being made in this project to determine the most troublesome weeds in this area, and equipment and methods best adapted to control them. Present indications show the need for more efficient weeders for farm use, better machines for cleaning ditch banks, machines for distributing dry herbicides, and for exploiting the use of electricity in weed control.

MECHANICAL HARVESTING OF COTTON

In cooperation with the Bureau of Agricultural Economics and the Mississippi Agricultural Experiment Station the Bureau continued test work started in 1936 with mechanical cotton pickers. Quality analyses of cottons mechanically picked showed improvement, in some cases, over 1936 results.

During the fall of 1937 observations were made on the performance of three spindle-type pickers and on one two-nozzle brush picker, pneumatic-conveyor type. Laboratory tests of samples of cotton picked by the spindle-type machine showed that foreign matter to the extent of from 4.7 (early picked) to 7.1 pounds (late picked) per 100 pounds of seed cotton was gathered as compared to 1.8 (early picked) and 6.6 (late picked) by hand picking for the correspond-

ing cottons. Cotton harvested early in the season by machine was more wasty, because of the green leaf picked with it, than cotton gathered later when the leaves had dried.

Machine pickers of the spindle type thus far have produced seed cottons in which leaf and other particles of foreign matter have become entangled in the cotton lint in such a manner as to be difficult to remove by present gin equipment. Under the best conditions the spindle pickers have produced lint from early-season cottons one to two or more grades lower than that from corresponding hand pickings. With the most extensive cleaning and extracting equipment the difference still remained approximately one and one-half grades. In the late-season cottons the difference between hand-picked and machine-picked was less because of the trash usually found in the hand-picked cotton. The staple length was not affected by the method of harvesting or by cleaning.

There is a striking difference in appearance between early cottons harvested by spindle pickers and those that have been carefully hand-picked. The machine samples show the effect of having been wound about the spindle. They were matted, entangled, and wadded in appearance, with quantities of green leaf throughout the locks. On the other hand early hand-picked samples are outstanding for the natural color characteristic of fiber, for individuality of locks, and for other general aspects of good quality.

At the gins during 1937 it was possible to remove only an average (early- and late-picked cottons) of 53 percent of a total of 5.9 percent of foreign matter (mostly leaf trash) from the mechanically picked as compared to 66 percent from a total of 4.2 percent of foreign matter (mostly burs) in the hand-picked cottons.

Percentages of cotton picked by spindle-type mechanical pickers have approached 90 percent of the available open cottons, while the amount knocked on the ground ranged from 3 to 8 percent as the season advanced.

Some of the pickers had undergone fundamental redesigning since 1936 resulting mainly in stepping up capacities through higher ground speed and the installation of additional picking equipment which does away with picking twice in succession. Capacity was increased by the building of a two-row picker the possibilities of which could not be determined before the close of the harvest season.

The 1937 ginning tests of machine-picked cotton indicate that some progress has been made in developing pickers that will harvest a better quality of seed cotton than previous pickers, but the results show there is still much to be done to maintain the quality of high-grade cotton during mechanical harvesting.

COTTON-GINNING INVESTIGATIONS

The United States Cotton Ginning Laboratories made more than 3,000 tests on more than 200 special lots of cotton and ran many miscellaneous engineering tests on fans, roller gins, driers, and on apparatus for which patent applications were being made.

The work of the laboratories has received increasing attention and practical application by the public. An outstanding example of public response is the wide use of the cotton-drying process developed by the laboratories. Reports indicate that at least 539 driers were in use during the ginning season of 1937–38 and handled more than 1,000,000 bales of damp seed cotton with benefits to farmers estimated at $650,000 or more.

Another example is the adoption by many ginners of the improved saws advocated by the laboratories. These saws have finer teeth than those previously used and obtain for the farmer approximately 20 additional bales of ginned lint per 1,000 bales of seed cotton.

SIMPLIFICATION OF GINS

The laboratories have found new facts on the handling of seed cotton by Rembert-type fans. A test during the season of 1937–38 confirmed previous ones showing that seed cotton can be handled through such fans without damage. It was further proved that this could be done with less power and air leakage than by means of the conventional suction separators and standard fans. Approximately 8,000 bales of staple cotton were handled by this method at cooperating gins with gratifying success. Several new ginning installations, on large planta-

tions in Mississippi, Arkansas, and Alabama, are designed to handle cotton in this way. The Rembert-type fan installation is cheaper and the power requirement much less, in many instances about half.

NEW DEVELOPMENTS IN COTTON DRIERS

Laboratory findings and improved designs resulting from the tests with Rembert-type fans have enabled the Department to develop driers for smaller gins where low first cost and economical operation are both vitally necessary. Improved Government designs of low-tower driers have been worked out that are adaptable to overhead cleaners on the one hand and to two-story gins with restricted headroom on the other. By means of a special junction Y, new forms of simplified feeding of damp cotton and hot air into the driers have also been developed with the result that separators have been eliminated and cost of installation has been reduced.

FAN AND PIPING TESTS

For several years the Department has recognized the waste resulting from inefficient gin piping and fan systems. Tests were begun in 1936–37 to obtain engineering facts relative to sizes and operating features of such systems. Approximately 5,000 tests have been conducted and an equal number remain to be completed.

As a result of the laboratory findings the old methods of cotton suction combined with seed blowing are rapidly being superseded by independent economical units which preserve the purity of the seed and do not contaminate it with dirt or objectionable trash. Wasteful leaks in the conventional separator suction systems under tests ran as high as 45 percent, and the use of the Rembert-type fans not only eliminated such leaks but have shown savings in power up to 15 horsepower in many instances. Tests on existing gin installations have shown cotton suction fans and separators consuming up to 40 horsepower on the larger gins. Substitution of Rembert-type unloading fans has dropped the power load to 25 horsepower. The tests have indicated that 10-inch suction piping should be ample for three-stand outfits, 11-inch for four-stand, and 12-inch for five-stand if conventional separators of good construction are used. But if Rembert fans are used the suction and discharge piping in the cotton unloading system may be standardized at 12 inches.

Seed-blowing tests indicate that with pure air and small sizes of piping not more than 1¾ horsepower per gin stand should be necessary.

GIN CAPACITY STUDIES

Tests of saw sharpening with triangular files gave better results than with new styles of rotary side files. Tests showed gin saws were reduced in diameter one-sixteenth of an inch by sharpening an average of eight times and confirmed last years' findings that there are appreciable losses in ginning capacity with loose-roll ginning and that the quality of the lint, when new-saw capacity was maintained, was lowered because the saw-diameter reductions caused more dense seed rolls. Reductions in the diameters of saws having straight teeth produced somewhat greater losses in capacity and lint turn-out than occurred with roach teeth because the continual sharpening of the latter tended to develop a virtually straight tooth. The angular side filing evidently produces not only a straighter backed tooth on the gin saw but in rounding its trailing edges tend to produce better carrying capacity per tooth. When saw capacity was maintained with saws reduced in diameter one thirty-second of an inch by sharpening the seed rolls gradually became tighter and caused damage to the lint which, combined with the reductions in the lint turn-out, caused bale value losses that averaged more than $2 with rotary side filing and more than $1 with angular side filing on roach-back teeth.

FARM-OPERATING-EFFICIENCY INVESTIGATIONS

Farm-operating-efficiency investigations concern the organization and improvement of all elements encountered in the development and operation of the individual farm. These investigations aim to reduce the cost of production and promote the enjoyment of farm living through the conservation and wise utilization of all farm resources—physical, economic, and human.

Since 1929 cooperative investigations have been established with the agricultural experiment stations in Minnesota, Michigan, Ohio, Virginia, North Carolina, South Carolina, and Georgia and with 120 farmers in these States. The studies are conducted on private farms in cooperation with the owners and the State agricultural experiment stations. The analysis reveals strong and weak points and serves as a basis for the development of a new operating plan should it be needed. The plan is essentially an outline of an operating program in which provision is made for necessary improvements and adjustments in land, labor, power, machinery, buildings, crops, and livestock for efficient operation of the farm. The completed plan represents a coordination of the farmers' experience and proved practices of the State agricultural experiment stations and the Department of Agriculture.

Complete operating plans were developed for eight farms in Minnesota and four in Michigan. Progress records are being obtained for all project farms in Minnesota, Michigan, Ohio, and Virginia. The original plans are being revised as needed. Brief records of development and progress on a few of the farms follow.

A Virginia truck farmer in 6 years completed the installation of overhead irrigation on 26 acres; terraced 15 acres of eroding land; built three new tenant houses, a two-story general-purpose barn, a two-story building in which to wash, grade, pack, store, and refrigerate produce, a poultry house for 200 hens, a two-car garage, a greenhouse, and a battery of coldframes; remodeled a tenant house; modernized his home; purchased new equipment including a general-purpose tractor, truck, sprayers, dusters, and planters; paid off the mortgage, and has paid for all the improvements from the profits.

This farm is now equipped to operate efficiently and reduce the hazard of weather. The terraces protect the land from erosion. Good rotations and fertilizing practices maintain soil productivity. Irrigation is protection in drought years and provides partial protection from frosts. The good tenant houses keep good labor contented and the fine balance of various farm activities provides steady employment. Good power and equipment permit doing work at the proper time and make crop production more efficient. Common storage and refrigeration make possible the harvesting of crops in optimum condition. The balanced type of business permits maximum production with minimum cost and minimum risk.

An Ohio farmer reorganized his farm to provide profitable employment for himself and his three sons. This was accomplished by providing more efficient production of feed crops, dairy, and poultry products and the development of a retail market. The changes involved drainage improvements, fencing, remodeling of the dairy barn, enlargement of the poultry and dairy enterprises, building of a modern dairy with equipment for pasteurizing, bottling, and refrigerating, and the purchase of a general-purpose tractor and delivery truck. These changes have converted a two-man farm into a profitable business for four men.

A Minnesota farmer confronted with a series of building, drainage, and clearing problems, said, as he adopted final plans for the complete reorganization of his farm: "I am through farming fields shaped like buttonhooks." Five years' progress on this farm has included remodeling of the barn, installation of drinking cups for the cows, erection of a new silo, drainage of 43 acres of land with 15,000 feet of tile, clearing 33 acres of woods, brush, and stumps, building a mile of new permanent fence, and purchase of a new general-purpose tractor, planter, and cultivator. These improvements have made 76 unproductive acres of the farm productive, decreased the number of fields from 16 to 7, reduced the amount of fencing required, and enlarged the fields to facilitate crop production and crop rotation. The building and equipment improvements make possible greater labor efficiency in the proper care of crops and livestock.

In 5 years a Virginia dairy farmer built a new dairy barn, a milking parlor, a dairy, a machinery shed, and four silos. He increased the area of the farm from 300 to 425 acres. The herd has been expanded from 70 to 100 cows. More than 100 acres of cropland have been tile-drained. New and special equipment used includes a ditching machine, standard tractor, general-purpose tractor and equipment, thresher, silage cutter, feed grinder and mixer, and a milking machine. Improvements in land, rotations, buildings, power machinery, and methods made possible the production of high-quality milk and the increased demand for this milk has made rapid expansion possible.

Efforts are now directed toward a more intensive study to determine separately and in combination the influence of land, soil, soil improvement, field arrangement, power, machinery, buildings, equipment, and labor on the successful organization of farms. Progress records indicate that the cooperating farms have improved materially through the better use of resources, the reduction of waste, the development of greater operating efficiency, the improvement in quality of produce, and the improvement of marketing methods.

EXTENSION WORK

The Bureau cooperates with the Department Extension Service to make the results of agricultural engineering research widely available to farmers. This same mechanism also facilitates the widespread use of engineering developments of the various State experiment stations in national and regional extension programs. More efficient use of educational materials and selection of the best extension methods result from assisting groups of States to cooperate.

Land-drainage maintenance work affecting Delaware, Maryland, Ohio, Indiana, Illinois, Iowa, Missouri, and Kentucky in counties served by C. C. C. drainage camps under the technical direction of the Division of Drainage of the Bureau was carried on as in previous years, stimulating and aiding county extension programs on drainage not only in the counties affected by the C. C. C. work, but in many others. In their annual statistical reports county agents in 959 counties recorded assistance on drainage work on 18,748 farms, with a service or savings value of $2,212,314.

As a result of Bureau assistance on irrigation activities in cooperation with State extension programs, specialists and county agents have devoted more time to this work. Reports from 556 counties showed extension assistance on irrigation problems valued at $2,442,206 on 9,000 farms. Most of this work was done in States west of the one hundredth meridian, but interest in irrigation is also developing in the humid areas farther east.

Land-clearing practices were reported from 433 counties with an extension aid value of $906,689 to the 15,938 farms benefited.

More than 800 counties reported better types of mechanical equipment brought into use on 28,565 farms; 671 counties reported 57,016 farms following instructions for maintenance and repair of machinery; and 463 counties reported 33,505 farms benefited by following recommendations for the efficient use of machinery. The valuation of benefits resulting from extension work on these three machinery activities was estimated at more than $4,000,000.

Good results with 120 farm building plans for the 12 Northeastern States, made available for farm use in Miscellaneous Publication 278, Plans of Farm Buildings for Northeastern States, have brought an increase in the activities of the cooperative farm building-plan service. Preparations for publication of two similar farm building-plan books were completed under the technical direction of the Division of Structures. A new book, Plans of Farm Buildings for Western States, for use in 11 States will soon come off the press, and Plans of Farm Buildings for Southern States, for use in 12 States, will be prepared this year. These plan books are intended for State and county extension workers, building-material dealers, and farmers in the designated areas. A reference list of extension bulletins of the Northeastern States on farm-building topics was also prepared for use by extension workers as a supplement to Miscellaneous Publication 278.

Statistical reports concerning new farm buildings built according to extension recommendations on 56,943 farms were sent in from 1,969 counties. They showed an estimated service or savings valuation of $4,843,276. Buildings remodeled, repaired, or painted on 70,176 farms were reported from 1,481 counties, with a service benefit valuation of $2,809,203. These figures include reports from 658 counties of 5,255 farm dwellings constructed, and from 738 counties of 14,173 farm dwellings remodeled according to plans furnished by extension agents.

Modern home equipment was installed in 85,760 farm homes, according to the reports of county agents. Nearly 1,000 counties gave effective assistance on the installation of water systems, and 901 on sewage systems; 893 counties conducted effective work on lighting systems, and 382 on heating systems.

Rural electrification extension work has been encouraged by facilitating the ready exchange of extension bulletins and other literature. Extension specialists prepared nearly 50 bulletins and circulars for this work in response to

the interest of farmers which had been greatly stimulated by the activities of the Rural Electrification Administration.

Agricultural extension agents from 1,048 counties reported advice and assistance rendered on 156,451 farms for new rural-line connections and 93,340 installations of electrical equipment for income-producing uses, with a service valuation of $3,304,877.

Cotton-ginning extension work is so new that extension statistics will be recorded for the first time in the 1938 reports. From the beginning of a ginning extension program by one State in the spring of 1936 this work has extended until the Cotton Ginning Laboratories are now cooperating with 11 States. The cooperative Extension Service of the Department and the States has been developing a uniform procedure in cooperation with the cotton-ginning laboratories.

INFORMATION AND PUBLICATIONS

In the 12 months preceding July 1, 1938, the Bureau issued the following printed publications, some of them in cooperation with other bureaus:

Making Lime on the Farm. Farmers' Bulletin 1801.
Modernizing Cotton Gins. Farmers' Bulletin 1802.
Fire Protective Construction on the Farm (revised). Farmers' Bulletin 1590.
Effects of Feeds and Saw Speeds on Cotton Turnout and Quality. Leaflet 151.
Artificial Drying of Forage Crops. Circular 443.
Cotton Gin Brushes: Care and Repair. Circular 467.
Performance Characteristics of 5- and 6-foot Combines. Circular 470.
Farm Building Surveys in Wisconsin, Kansas, Georgia, and Illinois. Miscellaneous Publication 311.
A Study of the Oil Burner as Applied to Domestic Heating (revised). Technical Bulletin 109.
Flow of Water Around 6-inch Pipe Bends. Technical Bulletin 577.
Spreading Water for Storage Underground. Technical Bulletin 578.
Rate of Flow of Capillary Moisture. Technical Bulletin 579.
Relation of Stable Environment to Milk Production. Technical Bulletin 591.

As a result of cooperative work between the Bureau and the Iowa Agricultural Experiment Station a publication—Labor, Power, and Machinery in Corn Production—was issued as Iowa Agricultural Experiment Station Bulletin 365.

The Office of Information issued some 40 press releases and more than 50 radio talks based on the Bureau's work. Forty-five papers were prepared by engineers of the Bureau for use in outside publications or for delivery at scientific and other meetings.

The Editorial and Information Division continued the publication of the Monthly News Letter and the monthly contributions to the Journal of Agricultural Engineering.

LIBRARY

Through a monthly publication and bibliographies issued at frequent intervals the use of the library by those interested in the applications of engineering to agriculture has greatly increased. A special effort has been made to assist field workers by calling their attention to magazine articles relating to their work and preparing short bibliographies for their use. Agricultural engineers connected with universities, colleges, and commercial firms are making use of the bibliographies.

A new catalog of public documents and congressional hearings on various bills has been added. The periodical and pamphlet catalog has grown by more than 3,000 items.

The preparation of bibliographies remains an important branch of the library work. Bibliographies were issued on irrigation, thatched roofs, frost protection, weed control, and flax.

To make library assistance more readily available for the two new Bureau projects—on the production and cultivation of flax and on the applications of electricity to agriculture—a short bibliography was produced on the former and a revision of an earlier bibliography on the latter subject is in progress.

Current Literature in Agricultural Engineering, issued monthly, contains short digests or brief descriptions of articles. It is sent to the Bureau personnel, agricultural engineers, and technical libraries. Requests for copies came from 15 foreign countries.

SERVICE WORK

The Division of Plans and Service has prepared plans and specifications for many projects authorized by different bureaus of the Department. In addition to the actual work of preparation of plans and specifications engineers of this Division checked and gave technical advice upon specifications for equipment and various building materials as drawn up by other bureaus. Service and technical advice were also given on proposed estimates, plans, and general policy regarding construction work. In many instances the engineering service given included the management of projects during construction.

The appraisal for the War Department of lands in the proposed floodways in the lower Mississippi Valley was completed. This work involved both fee and flowage-right appraisals on some 1,200,000 acres of land and was carried on cooperatively by the Bureaus of Chemistry and Soils, Agricultural Economics, and Agricultural Engineering, and the Forest Service. Since the completion of this work the appraisal unit of the Bureau of Agricultural Engineering has been making appraisals of flood damages and of flood-control benefits for the War Department on the Red River tributaries in Oklahoma and on the Tombigbee-Tennessee Rivers in Alabama and Tennessee.

The work for the Bureau of Biological Survey in constructing migratory waterfowl refuges covered 60 refuges or proposed refuges, of which 32 were under construction during the year. Special assistance has been given by engineers of the Bureau to State projects under the Federal Aid to Wildlife Restoration Act.

Some service work was performed by the Irrigation Division in the Western States, a description of which is given on page 15.

U. S. GOVERNMENT PRINTING OFFICE: 1938

For sale by the Superintendent of Documents, Washington, D. C. - - - - Price 5 cents

REPORT OF THE CHIEF OF THE BUREAU OF ANIMAL INDUSTRY, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., September 30, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I present herewith the report of the Bureau of Animal Industry for the fiscal year ended June 30, 1938.

Sincerely,

J. R. MOHLER, *Chief.*

CONTENTS

	Page		Page
Activities of special prominence	1	Packers and Stockyards Division	49
Animal Disease Station	3	Pathological Division	57
Animal Husbandry and Animal Nutrition Divisions	8	Division of Tick Eradication and Special Diseases	67
Biochemic Division	35	Tuberculosis Eradication Division	70
Field Inspection Division	39	Division of Virus-Serum Control	73
Meat Inspection Division	42	Zoological Division	75

ACTIVITIES OF SPECIAL PROMINENCE

During the fiscal year, as formerly, the work of the Bureau of Animal Industry embraced varied activities including research, control of animal diseases and parasites, inspection work, and the enforcement of Federal livestock laws and regulations. The United States remained free from several animal maladies that take heavy toll in many foreign countries. Among these potential invaders are foot-and-mouth disease, rinderpest, contagious pleuropneumonia, and surra. The freedom of the United States from these destructive maladies is attributable, at least in part, to quarantine measures and rigid inspection or suitable treatment of imported livestock and associated commodities. It is especially noteworthy that this country remained free of foot-and-mouth disease, notwithstanding extensive outbreaks of this malady in numerous European countries with which the United States has intimate commercial relations.

To control and eradicate diseases present in the United States, the Bureau has conducted numerous lines of field work, largely in cooperation with State livestock sanitary officials.

BANG'S DISEASE

Bang's disease of cattle has continued to dominate the interest and concern of cattle owners. In its endeavor to curb this malady, the Bureau has conducted an extensive cattle-testing project and, simul-

taneously, an active research program. The year's work revealed a demand for testing greater than could be supplied with the forces available. Agglutination blood tests were applied to more than 7,800,000 cattle in approximately 671,300 herds. Of the animals tested, 4.1 percent reacted, indicating the presence of the disease. At the close of the year 9,500,000 cattle were under supervision in the Bang's disease project, with an additional million on the waiting list.

Tests of two alleged drug remedies for Bang's disease showed them to be of no value as either preventives or cures. The results of these tests are in line with previous experience with medicinal remedies. No drug or combination of drugs has yet been found effective in the treatment of Bang's disease. However, experiments in calfhood vaccination, involving the use of biological methods, continue to be encouraging.

TUBERCULOSIS ERADICATION

In the Nation-wide Federal-State project to eradicate tuberculosis from cattle, three additional States qualified for admission to the modified tuberculosis-free accredited area. This advance, added to previous progress, leaves only one State—California—in which all counties are not in the modified accredited area.

There continues to be need for retesting herds of cattle to locate and eradicate any remaining infection. In the conduct of this work the combined forces of the States and the Federal Government applied tuberculin tests to about 14,000,000 cattle, of which about 0.6 percent reacted.

EQUINE ENCEPHALOMYELITIS

With no fewer than 30 States suffering ravages from equine encephalomyelitis in 1937, this disease has become of major importance to American horsemen. Death losses of affected animals averaged about 25 percent. In addition, the disease has greatly impaired the usefulness of work stock, especially during late summer and early fall months.

The Bureau's studies of this problem have shown the practical value of preventive measures, especially the importance of controlling mosquitoes and other bloodsucking insects. Such practices as stabling of horses and mules when not in use, spraying with repellents, screening, and general hygienic precautions have been definitely helpful. In addition, the Bureau has developed a vaccine, treated with formalin, to eliminate danger of spreading the disease, which has been more and more widely used each year.

ANIMAL BREEDING AND NUTRITION

Record-of-performance studies with beef cattle have shown that inherited differences observed in the progeny of different sires can be satisfactorily measured. A convenient basis of comparison is the number of pounds of gain in weight per hundred pounds of total digestible nutrients consumed.

Encouraging progress has been made in artificial insemination involving sheep as experimental animals. Through airplane transportation of semen, five ewes at Moscow, Idaho, produced living lambs sired by rams at the Agricultural Research Center. The distance

between the two points was approximately 2,600 miles; the age of the semen at time of insemination ranged from about 31 to 72 hours.

The value of green dried herbage in farm rations was demonstrated in two experiments. In one, good results were obtained, in both rate and economy of gain, in fall-farrowed pigs, by the addition to their feed of as much as 20 percent of ground alfalfa hay. In another experiment night blindness in cattle fed cottonseed meal and hulls was prevented by adding relatively small quantities of good-quality, green, leafy alfalfa hay.

VETERINARY EDUCATION

During the year 415 students graduated from accredited veterinary colleges, an increase of 132 compared with the preceding year. The total enrollment was 2,457, an increase of 150.

There are 10 accredited veterinary colleges in the United States, the number being unchanged from last year. The number of foreign recognized veterinary colleges was increased from 13 to 14 by the addition of the Superior Veterinary School, Constantinople, Turkey.

PERSONNEL

At the end of the year the Bureau rolls showed 4,394 regular employees of all grades and designations in Washington, D. C., and in the field, as compared with 4,012 at the beginning of the year. There was thus a net increase of 382 in the total number of regular employees. Additions consisted of 812 new appointments, 17 transfers from other bureaus or departments, and 10 reinstatements, a total of 839. Separations consisted of 133 resignations, 30 deaths, 16 transfers to other bureaus or departments, and 82 retirements under the provisions of the amended Retirement Act of May 29, 1930. Other separations, principally of agents, unskilled laborers, and seasonal and temporary employees, numbered 196, a total of 457.

In addition to regular employees, there were at the end of the year 2,553 emergency employees of various grades and designations in Washington and in the field service in various activities, principally in campaigns against bovine tuberculosis and Bang's disease, as compared with 2,845 at the beginning of the year. There was thus a net reduction of 292 in the total number of emergency employees.

The research and regulatory activities of the various branches of the Bureau are presented more fully as follows:

ANIMAL DISEASE STATION

The Animal Disease Station lost two of its oldest and most widely known investigators, W. E. Cotton, superintendent of the station, who retired on September 30, 1937, and J. M. Buck, his successor, who died on May 2, 1938. For the remainder of the year the work was directed by A. B. Crawford.

BRUCELLOSIS OF CATTLE AND SWINE

In cooperation with the Tuberculosis Eradication Division, field trials of calfhood vaccination were continued. Vaccine prepared from strain 19, a culture of *Brucella abortus* that is only slightly

pathogenic for guinea pigs, has been furnished to Government veterinarians in several of the States for use in herds heavily infected with Bang's disease. To June 30, 8,180 calves between 5 and 7 months of age had been vaccinated in 274 herds. Since only a small number of the vaccinated animals have passed through their first pregnancy, definite conclusions may not be expressed, but the results so far appear to be in close accord with those obtained experimentally as described in previous reports.

Relative to the continued immunity of cows that were vaccinated as calves in an infected environment under field conditions and that produced healthy calves on their first pregnancies, the results in a limited number of herds are very encouraging. These field trials were instituted in nearby herds several years prior to the cooperative project mentioned. The data, although too meager for positive conclusions, indicate that in most instances the immunity induced is still sufficient to enable such cows to produce healthy calves during their second and third pregnancies.

To determine whether the immunity resulting from vaccination during calfhood is maintained beyond the first pregnancy in the absence of exposure, an experiment was completed in which eight heifers—four vaccinated as calves and four controls—were permitted to complete their first pregnancy without artificial exposure to *Brucella abortus*. These eight animals were again bred, and during their second gestation period were exposed to *Br. abortus* via the conjunctiva. The animals were negative to the agglutination test at the time of exposure. All four control animals aborted and *Br. abortus* was isolated from the uterus and colostrum of each. Three of the four principals gave birth to normal vigorous calves. Guinea-pig inoculation indicated the absence of *Br. abortus* in these animals. The fourth animal gave birth to a weak calf that lived, but *Br. abortus* was isolated from both uterus and colostrum.

Studies on the transmissibility of infectious abortion from swine to cattle were completed. The 10 lactating cows reported last year as failing to contract porcine infection while they were nonpregnant were bred and were exposed under the same conditions to a new group of 6 pregnant sows. These sows had been artificially infected with a virulent porcine strain of *Brucella abortus*. Monthly agglutination tests of the blood serum of the cows and frequent tests of that of the sows were made. At no time during the period of gestation did any of the cattle react to the agglutination test in a titer higher than 1 to 25. Titers indicative of infection were obtained in all the sows. The presence of infection was further substantiated by the demonstration of *Br. abortus* (porcine) in the uteri of those sows that aborted.

The favorable results that have been reported from the use of certain sulphonamide compounds in the treatment of various infections, including undulant fever in man, suggested the advisability of determining their value in the treatment of Bang's disease. Preliminary investigations were carried out in which a 2.5-percent solution of prontosil (one of the earlier sulphonamide compounds) was administered intramuscularly to six guinea pigs artificially infected with a virulent bovine strain of *Brucella abortus*. The quantities of prontosil used were proportional to that found satisfactory in hu-

mans. Treatments were begun at varying intervals following initial infection of the guinea pigs. Six guinea pigs similarly infected were used as controls. The lesions and agglutination titers observed in the control and treated groups failed to reveal any value from the use of the drug as administered.

The second compound tested was sulphanilamide. Five cows were selected for this experiment, four of which had *Brucella abortus* infection in the udder at the time treatment was begun. Relatively high agglutination titers were present in the blood and milk of all five cows at this time. One cow received a total of 1½ pounds of the drug over a period of 5 days. Administration was by means of a stomach tube. A second cow was given approximately 2½ pounds of sulphanilamide in the same manner over a period of 6 days. The remaining three cows were treated with smaller quantities mixed with the feed. The concentration of sulphanilamide in the blood of the cows treated with the larger doses was almost double that recommended for the treatment of undulant fever in man. Repeated agglutination tests on the blood and milk of these animals, together with regular bacteriological examination of the milk for *Br. abortus*, failed to demonstrate any apparent therapeutic value resulting from the use of sulphanilamide.

The determination of the density of various antigens and vaccines used in connection with Bang's disease investigation has heretofore been made by visual comparison with the different tubes of the McFarland nephelometer scale. During the last year, the density of these suspensions was standardized at this station by means of a special apparatus that utilizes the deviation of a beam of light passing through the suspension to be tested and records the amount of deviation by means of a photoelectric cell and galvanometer. The varying densities are expressed on the galvanometer in different readings on the scale and are easily compared with a standard. This method has given excellent results in keeping densities of antigens and vaccines at a constant point.

In cooperation with the Division of Virus-Serum Control, tests were made of 231 samples of bovine abortion vaccine prepared by various commercial biological firms. Examinations for density, virulence, and purity were conducted. Of those tested, 179 were found to be satisfactory and 52 were either nonviable or contaminated and were condemned on the basis of the finding.

TUBERCULOSIS

Studies of the subcutaneous tuberculoid type of lesions, commonly called skin lesions, in cattle reacting to tuberculin tests were continued. The inability to grow, on culture media, the acid-fast organisms found in these lesions has been a decided handicap in determining the causative agent. Many different kinds of media have been tried recently, but none have proved to be effective in growing these organisms.

In October 1936 a number of strains of avian tubercle bacilli recovered from lesions in swine were used in inoculating intravenously 10 yearling bovine animals. Six of them died within 4 months of the Yersin type of tuberculosis, a type in which no definite lesions are observed but in which large numbers of organisms are found in the

various lymph glands and in some of the organs of the body, such as the spleen and liver. Four animals survived this treatment, but two of the four developed swellings around the joints of the legs about 8 months after inoculation. Pure cultures of avian tubercle bacilli were recovered from material aspirated from these swellings. These two affected animals are still alive but emaciated and walk with difficulty as a result of the swellings in the joints.

Thirty-eight samples of tuberculin prepared for veterinary use were tested for purity and potency. Six samples were found to be contaminated with dead acid-fast organisms, and six were deficient in potency. These 12 samples were ordered withdrawn from sale commercially.

Twenty-three samples of butter and cheese purchased on the local market were found to be free from contamination with virulent tubercle bacilli.

MASTITIS

Investigation of bovine mastitis, which was transferred from the Pathological Division to this station near the end of the previous year, was continued. All the animals in an experimental herd of streptococcus-free cows have completed, or are about to complete, their first lactation period. The herd consists of 15 milking animals. Streptococcus infection has not been detected in the udders of any of these cows. However, one or more quarters of some of the cows have become infected with micrococci. There appear to be two distinct species of these organisms that have not been definitely identified. One of these has been isolated with considerable regularity from 14 quarters of 7 cows and has been present in 10 of these quarters since parturition. However, its presence seems to be tolerated better by some quarters than by others, since abnormal values for pH, catalase, chlorine, and leucocytes were observed in only six of the affected quarters. The second species occurred in one quarter in each of two cows. That its activities caused greater injury to the organ than the first species was evidenced by both laboratory and physical tests.

A method was developed for staining large sections of unpreserved udder tissue as an aid in the detection of the changes that occur in the organ due to mastitis. By its use the normal glandular tissue, which does not stain, can be readily distinguished from the connective or scar tissue, which takes the stain.

The possible use of sulphanilamide in the treatment of chronic streptococcal mastitis was investigated. In the first experiment six cows carrying mastitis streptococci in one or more quarters of the udder were treated twice daily for 3 days with 5-gram doses of the drug sprinkled on the feed. The milk was examined bacteriologically before and after treatment. No curative effect was observed. In a second experiment, 15 grams of sulphanilamide was sprinkled on the feed of four cows infected in one or more quarters with mastitis streptococci, this being done twice a day for 8 days. The streptococcus infection in these animals was not affected by the treatment. In a third experiment, however, in which large doses of sulphanilamide were used, one of two cows with severe cases of chronic streptococcal mastitis was cured. In this connection it was found that an initial dose of 0.4 gram of the drug per kilogram of body weight and

subsequent doses of 0.15 to 0.2 gram per kilogram administered orally every 12 hours could produce and maintain a concentration of 15 to 20 milligrams of sulphanilamide per 100 cubic centimeters in the blood and milk.

EXANTHEMATOUS DISEASES

During the summer of 1937, severe outbreaks of an exanthematous disease occurred in three of the North Central States. An examination of specimens of infected tissue sent to this station showed that the disease was identical with the New Jersey type of vesicular stomatitis.

The desiccation, or drying, method for the preservation of viruses was applied to the virus of vesicular stomatitis. The affected pads of guinea pigs were placed in glass containers, frozen quickly with solid carbon dioxide, and dried under vacuum. The containers were sealed under vacuum and stored in a refrigerator. This dried material has proved to be infective after 4 months. This method of preserving the virus for long periods obviously will result in great saving of time and labor and in the shipment of viruses to distant points.

No outbreaks of vesicular exanthema of swine were reported.

POULTRY DISEASES

Near the end of the previous year, investigations in fowl leukosis were transferred to this station. They included (1) study of the incidence of spontaneous leukosis in chicks from an apparently normal flock and reared in a leukosis-free environment, (2) artificial transmission of leukosis through chick-embryo inoculation, and (3) genetic transmission of leukosis. In the first-mentioned investigation, 10 hatches of 673 chicks were reared. During the year, 56 birds, or 8.3 percent, developed spontaneous leukosis. Of these, 50 appeared in two hatches in about equal numbers. These cases were all of the tumorous type, commonly known as big-liver disease, in which enlargement of the liver was the most prominent lesion. The average weight of this organ was 265 grams, as compared with 40 grams in the normal bird. This enlargement is due to infiltration of the organ by immature lymphoid-type blood cells. Other organs showing lymphoid infiltration were, in order of frequency, spleen, kidney, bursa of Fabricius, and ovary. Five of the hatches, which remained in batteries throughout the growing period, were free of leukosis, whereas the other five, which were reared in colony houses with wire-floored sun porches or with earth runs, developed leukosis. A smear-preparation technique, quicker and less laborious than microscopic sectioning, was developed.

Previous artificial-inoculation experiments have shown that the younger the chicks the greater is the susceptibility to leukosis. To determine whether embryonic chicks would become infected, 116 chick embryos were inoculated with tissue suspensions from leukotic birds and 106 embryos were hatched as controls. Of the 116 embryos inoculated, 45 percent hatched, whereas of the 106 uninoculated embryos, 76.4 percent hatched. One chick inoculated as a 6-day embryo died, when 22 days old, of generalized leukosis of the tumor type. The experiment was discontinued at the end of 2 months.

ANIMAL HUSBANDRY AND ANIMAL NUTRITION DIVISIONS

Animal-husbandry investigations were conducted by the Animal Husbandry Division, under the direction of Hugh C. McPhee, Chief, and by the Animal Nutrition Division, under the direction of Paul E. Howe, Chief.

The work of the former Division consisted chiefly of research in livestock breeding and management. Search for superior types in livestock was continued as a means of increasing efficiency and economy of production in American livestock. Record-of-performance studies with cattle, sheep, and swine indicate that inheritance plays an important role in the variations in efficiency and quality of the progeny of different sires. The results indicate further that with the present lack of homogeneity in the breeding strains relatively little confidence can be placed in blood relationships as a measure of repeatability of performance. Closely related sires produce offspring that show significant differences in efficiency and quality of animal products. To improve this situation, projects have been initiated to develop inbred strains of livestock that, because of their greater homozygosity, should prove superior for outcrossing and cross-breeding.

The work of the Animal Nutrition Division consisted chiefly of research in livestock nutrition and feeding and the effect of methods of feeding on the quality of animal products. The object was to determine the nutritional requirements of various classes of animals, especially during the early stages of development when the effects of improper feeding are most evident, during the active reproductive life to insure satisfactory reproduction, and during fattening.

Because of the closely related nature of the foregoing fields of study, the work of the two Divisions is reported jointly.

BREEDING AND FEEDING INVESTIGATIONS WITH SMALL ANIMALS

Genetics investigations with guinea pigs were continued with four inbred strains and a noninbred control strain. The year's studies showed the influence of inbreeding and cross-breeding on the differentiation of the strains for various anatomical and skeletal characters.

As a result of inbreeding, certain strains have become noticeably different from others and from the control strain in size and shape of some of the internal organs and in certain skeletal characteristics. Differences were observed in shape and size of spleen and size of the adrenal glands and kidneys. Of all the organs studied, the heart was the most constant in size and weight. Intestine length was closely related to general body size and had remarkably low variability. Weights of blood, front and hind quarters, liver, pituitary gland, and testes were closely related to live weight of the animal, but weights of thyroid, adrenals, spleen, and kidneys had little relation to live weight.

In size of skeleton, a remarkable uniformity was found among the inbred families. The control stock had somewhat larger skeletons than the inbred families. In crosses between the inbred families there appeared to be some degree of heterosis in the first generation, as shown by larger skeletal size. Since there is little variation in

skeletal size of the animals of the different families, variations in general size of the live animal are due mostly to differences in musculature. This finding is also suggested by considerable differences in scapula area among certain families. It was found that approximately 13 percent of the variance of bone length was due to age, 37 percent to heredity, and 8 percent to sex, whereas for bone weights the corresponding percentages were 10, 23, and 12 respectively.

Studies of the inheritance of intelligence and temperament in domestic animals were continued, with dogs as the experimental animals. Definite progress was made in the development of tests for measuring the reactions of dogs. Three new tests of behavior, in addition to the leash test, whistle test, and sheep-herding test already being used, were developed. These include an observation test of the behavior toward sheep of the puppy at 6 months of age, tests of the reaction to a strange person of the dog at 1 year of age, and tests of the behavior of the dog in a multiple-choice apparatus, with the trainer making observations through a screen from the adjoining room. Correlation studies among the various tests indicate that in general they measure different characteristics. A few of the dogs have made relatively high scores on most of the tests. Data on the inheritance of body form, type of hair, and color in dogs are being obtained as an incidental phase of the program.

In expressing the nutritive value of feeds, it has been customary to treat the carbohydrate portion in terms of crude fiber and nitrogen-free extract. For many years crude fiber has been determined by an empirical method, admittedly not an exact one, for differentiating the highly digestible from the poorly digestible carbohydrate. Among the various new procedures of analysis proposed in recent years is one employing enzymes found in the digestive tract of animals. To obtain a more accurate expression of the poorly digested portion of grasses and hays, a study was made of the enzymatic procedure in connection with digestibility experiments with rabbits. The results indicate that a much higher percentage of grass or hay remains as crude fiber by the use of the enzymatic than by the conventional empirical method. In the rabbit, only a small percentage of the crude fiber (undigested residue) determined by either method is digested, but a somewhat higher portion of the nitrogen-free extract determined by the enzymatic method is digested than by the conventional method.

In studies on the vitamin requirements of livestock, confirmatory evidence was obtained on the multiple nature of vitamin G. Pure riboflavin and crystalline vitamin B_1 did not supply all the vitamin B-complex for rats. A substance, presumably vitamin B_6, found in third-run cane molasses and in liver concentrate prevented a florid dermatitis in rats. A combination of crystalline B_1, riboflavin, third-run cane molasses, and the W factor supplied enough B vitamins to give nearly normal growth. With the various diets used, 175 gamma of riboflavin per rat per week supplied all the apparent demands of the animal for riboflavin.

MEAT INVESTIGATIONS

Meat investigations included both independent studies and cooperative ones with the Bureaus of Agricultural Economics and Home Economics and 11 State experiment stations.

Through analysis of accumulated data, a classification of lamb carcasses on the basis of fatness was developed. Dressed carcasses containing more than 35 percent of fat (ether extract) in the edible portion were classified as fat; those containing 20 to 34 percent, as intermediate; and those of less than 20 percent, as thin. The approximate average physical composition, including separable fat, lean, total edible meat, and bone, was determined for the leg, rib, shoulder, loin, neck, and breast cuts from carcasses of each class and chemical composition for the leg, rib, and shoulder cuts. Leg cuts, for example, contained 18.5, 14.4, and 7.6 percent of separable fat and shoulder cuts 27.1, 18.0, and 11.5 percent for the fat, intermediate, and thin classes, respectively. The results should be useful as a guide to housewives, chefs, dietitians, and others in the purchase and utilization of lamb.

In cooperation with the West Virginia Agricultural Experiment Station, a study was made of lambs produced at Hillsboro, W. Va., by crossing Corriedale rams on native West Virginia ewes of Hampshire type. When weaned, second-cross Corriedale lambs were heavier, had a higher dressing percentage, and produced higher grading carcasses than third-cross lambs containing 87.5 percent of Corriedale blood. The meat of the former group was also more tender, as shown by results from roasted leg cuts.

In agreement with results obtained during the previous fiscal year, Suffolk-sired range lambs from Corriedale and Rambouillet ewes produced at the United States Sheep Experiment Station, Dubois, Idaho, weighed more at weaning time than Hampshire-sired lambs from the same breeds of ewes. However, the Suffolk-sired lambs produced less tender leg roasts. In another cross-breeding study, carried on in cooperation with the Wyoming Agricultural Experiment Station, Lincoln × Rambouillet range lambs produced definitely less tender meat than comparable lambs sired by Corriedale, Columbia, and Romney rams and from Rambouillet ewes. This finding also agreed with that of the previous year. Although the results of these experiments and the West Virginia experiment do not necessarily indicate that such results would be obtained from any breed or cross between breeds, they do show that tenderness of meat may be associated with the breeding of the animals.

Further research on the carcasses and meat of hothouse lambs produced at the United States Morgan Horse Farm, Middlebury, Vt., showed that on the average Southdown-sired lambs from Dorset × Delaine Merino ewes were less fat and had a lower proportion of edible meat than Southdown-sired lambs from Dorset ewes or from Dorset × Tasmanian Merino ewes. The first-mentioned lambs also graded lower as dressed carcasses and were less plump in the leg than the lambs of the other two crosses. No appreciable difference in tenderness of the roasted legs was observed. All three crosses produced meat highly satisfactory in this respect.

Lamb rib cuts, consisting of the fourth to twelfth ribs, inclusive, were frozen at 0° F. at the Agricultural Research Center and then stored at 0° and 18°, some being protected by wrapping and some unprotected from air. During 252 days of storage the unprotected cuts at 0° and 18° lost 14.0 and 18.3 percent in weight, respectively, whereas those protected from air remained practically constant in weight. Data for the first 168 days of the storage period indicate

that with increase in storage time there was some increase in free-fat-acid content of the lean tissue of the meat stored at both temperatures. However, the increase was less for the lean of the meat stored at 0°. There is no definite evidence that the free-fat-acid content of the fat tissue increased with time up to 168 days under any of the four sets of storage conditions. However, with 168 days of storage at 18°, the flavor of fat of both the protected and unprotected samples had a rather definite decrease in desirability.

Lamb legs were cured at 38° F. for 5 to 6 days per pound in sweet pickle containing 12.5 percent of salt and then smoked 18 to 20 hours at approximately 110°. They withstood a storage period of 28 days at 68° better than similar lamb legs cured for shorter periods. After storage the meat of the lamb legs cured for 5 to 6 days per pound contained approximately 4.5 percent of salt, which was 15 to 16 percent more than was contained by their pair mates, which were not stored. This increase is largely accounted for by their shrinkage during the aging process. While the legs were curing, salt was found in greatest quantities in the muscles adjacent to the fell. The inside muscles, the adductor and vastus intermedius, were the last to absorb the salt. The aging process, however, was accompanied by a shifting of salt and moisture between muscles, which procedure tended to equalize the salt distribution. As a result, the previously mentioned inside muscles consistently gained in salt, whereas outside muscles, notably the gracilis, decreased in salt content. Palatability data were obtained on other lamb legs weighing, 5, 6, and 7 pounds that were cured 5 to 6 days per pound. These data indicated that subsequent storage for 31 days at 68° increased the intensity and decreased the desirability of the aroma, flavor of fat, and flavor of lean. The decrease in desirability was least for the 7-pound legs.

A study on the conformation of hams was completed at Beltsville. The ratio of circumference to length of ham from aitchbone to hock joint was used as the index of conformation or plumpness. Of the several ham components studied, percentage of separable fat was most closely related to plumpness. Percentage of separable lean was inversely and much less closely related. Of the four largest ham muscles, the percentage of rectus femoris muscle was most closely related to plumpness. The proportion of edible meat in the ham, including both fat and lean, was more closely related to conformation than any single factor studied. Other factors associated with ham conformation were ratio of length of hind leg to width of carcass through hams, length of ham per unit of weight, and thickness of back fat. The results of this study should give breeders, feeders, consumers, and others a better conception of the significance of variations in the conformation of hams.

The percentage of lean in the cross-section cut of bacon was determined in a comparative study of 47 Danish Landrace, 53 Poland China, and 48 Duroc-Jersey hogs produced at Beltsville under uniform feed and management conditions. Average type was the same in all three groups, and the animals were slaughtered as they individually reached a weight of approximately 225 pounds. All bacons were cross-sectioned at the sixth rib, photographed, and with a planimeter the areas of the total cross section and the lean portions were measured on an enlargement of the photograph. Calculations from the data obtained showed that on the average the Landrace

bacon contained 26.7 percent of lean, the Poland China, 24.0 percent, and the Duroc-Jersey, 21.3 percent. These results are of particular interest when it is considered that in thickness of back fat and percentage of fat, including back, leaf, and cutting fat with plate, the Landrace carcasses were intermediate, the Duroc-Jersey highest, and the Poland China lowest.

In line with previous reports, the dressed carcasses of Danish Landrace hogs produced higher average percentages of ham, bacon, and loin and lower percentages of head, picnic shoulder, plate, and back fat, and also thinner back fat, than the Bureau's strain of Duroc-Jersey hogs. Duroc-Jersey × Landrace carcasses were intermediate in percentages of bacon, loin, head, picnic shoulder, and back fat and in thickness of back fat, but the percentage of ham was higher than for animals of either of the parent breeds. The carcasses of backcross hogs, having 75 percent of Duroc-Jersey and 25 percent of Landrace blood, were between the Duroc-Jersey and Duroc-Jersey × Landrace carcasses in percentages of head and plate and in thickness of back fat but produced as much ham as the carcasses of the first-cross hogs and slightly lower percentages of bacon, loin, picnic shoulder, and back fat.

The carcasses of Large Black hogs, an English breed, were found to have lower percentages of ham, bacon, and loin and higher percentages of head, picnic shoulder, plate, and back fat, as well as thicker back fat, than the carcasses of Danish Landrace hogs. The percentage of loin was much lower and the percentages of plate and back fat much higher. The thickness of back fat was approximately 27 percent greater than that of the Landrace. Moreover, the Large Black hogs dressed less than the Landrace. Large Black × Landrace carcasses were intermediate in percentages of ham, bacon, loin, plate, and back fat and in thickness of back fat. In yield of head and picnic shoulder, the cross-bred hogs were lowest and in dressing percentage highest of the three groups.

Pork-loin cuts, consisting of the fourth to twelfth ribs, inclusive, were frozen at 0° F. and subjected to the same low-temperature storage conditions as were the lamb cuts previously mentioned. During 252 days of storage, the unprotected cuts lost 6.3 and 13.7 percent in weight at 0° and 18°, respectively. Pair mates at the same storage temperatures but unexposed to air had little weight loss. Data available for the first 168 days of storage indicate no appreciable change in free-fat-acid content of the meat held at 0°, but both lean and fat tissues of protected and unprotected samples stored at 18° had a rather definite increase in this constituent with increase in time. Likewise, after 168 days of storage at 18°, the desirability of aroma, flavor of fat, and flavor of lean of both the protected and unprotected samples had decreased and was less than that of the corresponding samples stored at 0°. These results indicate that the proper temperature for storage of such meat for a period as long as 168 days is somewhat lower than 18° although not necessarily so low as 0°.

In cooperation with the Maryland Agricultural Experiment Station, salt penetration and moisture changes were studied in 15-pound paired hams dry- and brine-cured for various periods ranging from 5 to 60 days. The curing mixture consisted of 8 pounds of salt, 2 pounds of sugar, and 2 ounces of saltpeter per 100 pounds of meat.

In dry curing, two applications were made whereas their pair mates were immersed in a 73° pickle. As the curing progressed in both groups of hams, salt penetrated into the muscles in closest contact with the face of the ham and from these muscles into adjoining ones adjacent to the skin side. The lowest percentage of salt was in the vastus intermedius muscle surrounding the femur bone. This muscle, owing to its location, is rather inaccessible to salt penetration. Subsequent chemical analysis indicated that it contained the least moisture and the most fat of any of the ham muscles examined. This fact in itself probably was sufficient to prevent rapid salt penetration. Little salt absorption took place through the skin or fat side. There was a tendency for the lean tissue to lose moisture during cure. This loss occurred of course at a faster rate in the dry-cured hams than in their pair mates in brine cure.

A summary of data on carcasses of 26 beef-type and 54 dual-purpose-type Shorthorn steers, produced under uniform conditions of feeding and management in performance studies at Beltsville, and slaughtered at approximately 900 pounds of live weight, brought out important differences. The carcasses of the beef cattle yielded the higher average percentages of brisket, navel, short loin, flank, and kidney knob, all of which, except short loin, being relatively low-priced cuts. On the other hand, the carcasses of the dual-purpose steers yielded higher percentages of chuck, shank, and round, and slightly more loin end. In yield of rib cut and rump there was little difference between the two types. The dual-purpose steers were about 5 percent longer in body and were also deeper at the seventh rib, although the difference in this instance was relatively small. Beef carcasses were wider, both through shoulders and rounds, than carcasses of the other type. Of particular interest was the fact that the flesh at the end of the rib bones in the rib cut was 50-percent thicker in the beef carcasses.

In cooperative work with the Michigan Agricultural Experiment Station paired calves were fed to approximately the same degree of finish, one group being on a limited and the other on a full ration. A 2-year summary shows that during a feeding period nearly 60-percent longer the limited-fed cattle gained about 45 percent more in weight than their pair mates to attain practically the same fatness. Little difference was found between the two groups of cattle in factors such as carcass grade, color of lean, and tenderness of roasted meat. However, the limited-fed cattle, with only 3.6 percent more fat (ether extract) in the entire edible portion of the ninth- tenth- eleventh-rib cut, had 33 percent more fat in the eye muscle of the same cut. This result indicates that rate of fattening has a definite bearing on fat distribution.

In cooperation with the North Carolina Agricultural Experiment Station, a study was carried on with paired yearling cattle, one group being fed lespedeza hay and the other a limited ration of shelled white corn and lespedeza hay. Both animals of each pair were slaughtered when the grain-fed individual attained a weight of 1,000 pounds. All grain-fed animals dressed higher and, with one exception, their carcasses graded higher than those of their pair mates, the average difference being two-thirds of a grade. The ninth- tenth- eleventh-rib cuts, used as carcass samples, contained 33.7 percent of separable fat, on the average, in the case of the grain-fed cattle and 20.2 percent in

the case of the cattle fed hay only. In general, the roasted meat of the grain-fed cattle showed greater tenderness. In other palatability factors the differences between the two groups were small and unimportant.

At Beltsville, studies were begun on the curing, smoking, and storage of dressed turkeys. Birds weighing an average of 16.5 pounds were packed in 50-gallon barrels, six birds per barrel, and covered with brine solution containing approximately 13 percent of salt, 6.4 percent of sugar, and 0.4 percent of saltpeter. The curing was done at a temperature of approximately 38° F. Salt and moisture determinations were made on the cured, smoked, and stored meat after curing periods of 1, 2, 3, and 4 weeks. At least 3 weeks' curing was necessary to insure satisfactory meat when the cured, smoked turkeys were subsequently stored 4 weeks at 68° F. This period was necessary primarily because of the slowness with which salt penetrated into the meat of the drumstick and the development of mold in the thoracic and abdominal cavities when shorter curing periods were employed. An additional week of curing resulted in little advantage over the 3-week period. The thigh and wing meat took up salt rapidly. Smoking the cured turkeys 20 hours at 110° F. produced as desirable color over the breastbone only. During storage there was a continuation of the dehydration that occurred during smoking, accompanied with salt movement within the meat that resulted in a more uniform distribution of salt.

For a number of years search has been made for convenient and rapid means of expressing characteristics of hog carcasses, such as fatness, that have an important bearing on the quality of the meat. Previous work has shown a high correlation between average thickness of back fat and the percentage of fat in the edible portion of the carcass. A further study of the relation between separate measurements of the thickness of the back fat taken at five locations along the split carcass and the average of these five measurements showed high correlation in all cases. The measurements taken over the seventh rib and over the loin were the best indices of thickness. Of the five measurements, the value for thickness over the loin was nearest to the average thickness of back fat. Thickness of back fat and live weight of hog also had a linear relationship. Within the limits of the study the ration had little influence on fatness as indicated by thickness of back fat. On the other hand, type and strain of breeding appear to be important factors in determining the fatness at a given weight of an animal.

BEEF AND DUAL-PURPOSE CATTLE INVESTIGATIONS

BREEDING INVESTIGATIONS

Experiments were carried on at the Agricultural Research Center to establish superior strains of beef Shorthorn cattle. Steers of one strain averaged 17.2 pounds of gain, per 100 pounds of total digestible nutrients consumed, from the time the animals were weaned at 500 pounds of weight, until they were slaughtered at 900 pounds. During the same period another strain averaged 15.4 pounds of gain, which was significantly less. Other tests showed that the progeny of one bull averaged 16.9 pounds of gain per 100 pounds of total digestible nutrients consumed, whereas the progeny of his three-

quarter brother averaged 14.2 pounds, the difference also being significant. The progeny sired by one bull dressed appreciably higher than those sired by the other bull. The former group also was fatter, on the average, and the meat contained a lower percentage of lean. However, the bone content was slightly higher and the intramuscular fat (ether extract) content definitely lower than for the group with the lower yield of carcass.

Studies showed that the use of a constant weaning weight for calves on progeny-performance tests, as used by the Bureau, is superior for experimental purposes to the use of a random weaning weight combined with a constant slaughter weight, since the former does not materially affect the slaughter or carcass grade of the animals on test, whereas the latter does.

Twelve Milking Shorthorn steers (dual-purpose type) on record-of-performance test at Beltsville made an average daily gain of 1.37 pounds during the 297 days required to reach 900 pounds of weight, as compared with an average daily gain of 1.60 pounds during 254 days for 15 beef Shorthorn steers. The Milking Shorthorns dressed 56.8 percent and produced 14.4 pounds of gain for each 100 pounds of digestible nutrients consumed, whereas the beef Shorthorns dressed 59.9 percent and made 15.8 pounds of gain for each 100 pounds of digestible nutrients consumed. The Milking Shorthorns required 230 days to reach a weaning weight of 500 pounds as compared with 242 days for the beef Shorthorns.

In a study of the body measurements of beef Shorthorn and Milking Shorthorn steers, a significant amount of the variation in gain in weight between sexes and between types was attributable to differences in skeletal growth. Although the Milking Shorthorns weighed approximately the same at 1 year of age as the beef Shorthorns, the former's gain to 1 year of age was due largely to an increase in skeletal size, whereas in the beef Shorthorns there was a larger increase in flesh. In both types the bull calves made greater skeletal growth than the steers and the steers more than the heifers.

Correlation studies showed that slaughter grade can be determined with reasonable accuracy from the height at withers and weight of the animal.

At the Iberia Livestock Experiment Farm at Jeanerette, La., in cross-breeding studies with Guzerat, Africander, and Aberdeen Angus cattle, half-bred Guzerat × Angus calves weighed more at birth than calves of the other crosses. The Africander × Angus calves ranked next, and three-eighths Guzerat × five-eighths Angus calves sired by half-bred bulls and out of quarter-bred cows (one-fourth Guzerat × three-fourths Angus) were lightest at birth. The heavier weight of the half-bred calves was not maintained as they developed, for quarter-bred Angus × Guzerat calves sired by purebred Angus bulls and out of half-bred Guzerat × Angus cows reached a weaning weight of 450 pounds 23 days earlier than the half-bred calves. This advantage did not hold, however, for quarter-bred calves sired by a half-bred sire and out of purebred Angus cows. The superior weights of the Angus × Guzerat calves is attributed to the superior milking qualities of the Guzerat cow over the purebred Angus cow. These results indicate the value of having Guzerat blood in the females.

In record-of-performance studies at Jeanerette, cross-bred steers possessing Guzerat and Aberdeen Angus blood made more efficient gains than purebred Aberdeen Angus steers although the latter produced the more desirable carcasses.

In a study of inheritance of horned and polled character in Guzerat × Angus crosses at the Jeanerette station, the first-generation males were all horned or scurred, whereas 25 percent of the females were polled and 75 percent had horns or scurs. In the backcross to the polled parent, practically 50 percent of the males were polled and 50 percent were scurred, whereas 91 percent of the females were polled. There were no polled Africander × Angus cross-breds, as males and females alike were either horned or scurred.

Studies at Jeanerette on the effect of environmental conditions on the respiratory rate and body temperature of Guzerat, cross-bred Guzerat × Angus, and purebred Angus cattle indicate that Guzerats are the least affected by increases in atmospheric temperature whereas purebred Angus cattle are the most affected. When the animals were exposed to the direct sunrays, the respiratory rate of the purebred Angus increased 350 percent whereas that of the purebred Guzerat cattle increased only 8 percent. The body temperatures decreased in direct proportion to the percentage of Guzerat blood carried. Solar radiation and hot summer temperatures in the Gulf coast region influenced the grazing habits of the cattle. On bright, clear days with temperatures of more than 80° F. in the shade, the purebred Guzerat utilized about 74 percent of the daylight hours in grazing whereas the purebred Angus utilized only about 50 percent. When not grazing, the latter animals rested in the shade whereas the purebred Guzerats rested entirely in the sun.

Record-of-performance studies of Hereford cattle were continued at the United States Range Livestock Experiment Station, Miles City, Mont., in cooperation with the Montana Agricultural Experiment Station, to establish superior breeding strains of cattle particularly adapted to the western range country. Two years' results of fattening trials were completed in which steer calves sired by three rather closely related bulls were fed to an average weight of approximately 900 pounds on cracked corn and alfalfa hay. There were no apparent differences in type, conformation, or breeding among the three bulls. The results show that the progeny from one bull were significantly superior in efficiency of gain to the progeny of the others. His steer calves averaged 19.59 pounds of gain per 100 pounds of total digestible nutrients consumed; those of a second bull, 18.17 pounds; and those of the third bull, 18.06 pounds. Heifers sired by the first bull were 14.7 percent heavier at weaning time and 7.4 percent heavier at 18 months of age than those sired by the second bull, and 10.5 percent heavier at weaning time and 2.4 percent heavier at 18 months than those sired by the third bull. These results show the superiority in breeding performance of the first bull, notwithstanding the apparent similarity of the animals.

In experiments carried on at Penny Farms, Fla., in cooperation with the Florida Agricultural Experiment Station, observations indicated that the first-cross progeny of purebred bulls and native cows have from 25- to 33-percent greater total sales value as slaughter animals than the progeny of animals of strictly native breeding.

FEEDING INVESTIGATIONS

At Beltsville, investigations on nutritional deficiencies of cattle and methods of detecting and correcting resulting diseases or disorders were begun. Initial studies involve the effect of vitamin A deficiency on the reproductive and urinary systems of beef and dual-purpose cattle. A quantitative measure of vitamin A deficiency and optimum vitamin A nutrition is being studied by the determination of β-carotene, the precursor of vitamin A, and possibly preformed vitamin A in the blood of these cattle. Results indicate that the determination of the amount of yellow color in the carotene-containing extract of blood obtained by the usual methods is not always a true measure of carotene since spectrophotometric determinations on such extracts often show considerable amounts of impurities. These impurities are measured as carotene by the ordinary colorimetric methods.

The second year's experiment at Big Spring, Tex., in cooperation with the Bureau of Plant Industry and the Texas Agricultural Experiment Station, showed that steers full-fed ground threshed milo made greater gains and had a higher dressing percentage and slightly higher carcass grades than those receiving approximately 80 percent as much milo, other feeds being constant. There were no significant differences in gains between individually fed steers and those fed in groups at the same level of feeding. The steers fed limited quantities of milo, whether individually or by group, made more efficient use of their feed. These results agreed closely with those of the previous year.

In vitamin A deficiency studies at Spur, Tex., in cooperation with the Texas station, it was found that the time required for visible evidence of depletion to appear varied considerably in animals of different ages and in those of the same age. With calves the average time was 137 days and with yearlings 142 days. There were no significant differences in gains of steers between groups on feeds containing varying quantities of carotene. Results indicate that 800 micrograms of carotene per 100 pounds of live weight per head daily is not sufficient to control night blindness, which is the first general indication of vitamin A deficiency. Convulsions and complete night blindness have occurred when levels of 750 and 800 micrograms of carotene were fed. In previous experiments levels of 2,000 and 2,400 micrograms apparently restored affected night vision to normal. In this year's experiment steers on 1,000- and 1,250-microgram levels approached total night blindness but were less affected than steers receiving 800 micrograms. The general health of steers receiving 1,500 and 2,000 micrograms was much better than that of steers receiving smaller quantities. However, they also were considerably affected with night blindness.

In mineral-deficiency studies conducted in cooperation with the Texas station and the King Ranch near Kingsville, analyses of grass samples collected on cattle ranges throughout the Gulf coast area indicate a sufficiency of calcium and a serious deficiency of phosphorus. The calcium content of the grasses varied little from month to month, but the phosphorus content varied directly with the stage of growth of the grasses and inversely with the amount of rainfall.

The ratio of calcium to phosphorus becomes extremely wide during the dormant winter period and also during droughts in summer. Bonemeal, disodium phosphate, and bonemeal with small quantities of iron, copper, cobalt, and boron and zinc salts are being fed to 2-year-old heifers to correct the mineral deficiencies in the vegetation. The supplements are fed so as to supply 6.5 grams of phosphorus per head daily. Although the feeding of the minerals has been under way only 6 months, all three mineral-fed groups have a significantly higher percentage of inorganic phosphorus in their blood than the control group of heifers that receive no mineral in addition to the range. The beneficial effect of supplying phosphorus-containing feeds is shown in the improved appearance of the cattle and their increased weight over that of the controls.

In feeding experiments at Tifton, Ga., in cooperation with the Georgia Experiment Station and the Georgia Coastal Plain Experiment Station, steers fattened in dry lot on ground snapped corn, ground velvetbeans, and peanut hay gained 2.25 pounds per head daily, and returned $1.09 per dollar invested, whereas those fed unhusked corn, whole velvetbeans, and peanut hay gained 2.11 pounds per head daily and returned $1.08 per dollar invested. Others fed unhusked corn, cottonseed meal, and peanut hay gained 2.22 pounds and returned $1.07 per dollar invested. A ration of cottonseed meal and hulls was the least satisfactory both in steer gains and in net returns. In this year's test, substituting molasses for one-fourth the corn fed gave a slightly better return than substituting molasses for half the corn but a slightly less favorable return than the ground-corn and velvetbean concentrates.

In an experiment at Miles City, Mont., to determine the relative advantage of producing steers for market as yearling feeders or as 2-year-olds for slaughter, the latter were more profitable. In the previous year's work no advantage was found in carrying the steers an additional year before marketing them.

At Raleigh, N. C., an experiment was carried on in cooperation with the North Carolina station to compare results obtained from feeding all-roughage and limited corn-and-roughage rations. Yearling feeder cattle grading Good gained 236 pounds per head, or 1.74 pounds daily, when fed to weights of 1,000 pounds on a ration averaging 9.9 pounds of shelled white corn and 11.2 pounds of lespedeza hay. Similar cattle, paired with those fed corn, gained 128 pounds per head, or 0.9 pound daily, on an average ration of 19.2 pounds of hay. Those fed corn were noticeably fatter, graded high Good at slaughter, and dressed 5 percent higher than the cattle fed hay only, which graded low Good when slaughtered. Feed costs per 100 pounds of gain were $16.35 for the former group and $21.95 for the latter.

An experiment with calves fattened in dry lot was continued at Sni-a-Bar Farms, Grain Valley, Mo., in cooperation with the Missouri Agricultural Experiment Station, to determine the desirability of substituting molasses for one-half the shelled corn in a ration including alfalfa hay. The ration containing molasses was approximately 65 percent as efficient as the shelled-corn ration, in terms of feed consumed per 100 pounds of live weight. With corn at $40 a ton and molasses at $22 a ton, the feed cost per 100 pounds of gain of the group fed shelled corn was 7 cents higher than that of the

group fed molasses. However, this higher cost was more than offset by the higher finish and valuation of the steers fed shelled corn. These results agree with those of the previous year.

PASTURE AND RANGE UTILIZATION

At the Ardmore Field Station, Ardmore, S. Dak., experiments to compare alternate and continuous methods of grazing native range with yearling steers for a period of 1 year showed that 20 acres of native range, consisting largely of western wheatgrass, buffalo grass, and blue grama, was sufficient to carry a yearling steer for the entire year. There was no advantage in alternating the grazing from one-half of the area to the other every 28 days. In either alternate or continuous grazing, the steers at the end of the year were sufficiently finished to sell as slaughter cattle. In previous experiments similar steers, grazed only in the summer on such range at the rate of 10 acres per head, did not have sufficient finish for slaughter and accordingly sold as feeders.

In a grazing experiment at the United States Range Livestock Experiment Station at Miles City, in cooperation with the Forest Service and the Montana station, average results for 4 years with breeding cows on native range for 11 months each year showed that moderate grazing is more conducive to satisfactory calf production than is intensive grazing. A moderate rate of stocking—30.5 acres per cow—resulted in 250 pounds of calf per cow. A light rate of stocking—38.8 acres per cow—resulted in 230 pounds, whereas stocking at the rate of 23.1 acres per cow resulted in only 180 pounds of calf per cow.

At Sni-a-Bar Farms a study was carried on in cooperation with the Bureau of Plant Industry and the Missouri station to determine the effect of pasture-management methods on gains of steers. Rotation grazing of bluegrass pasture, supplemented in midsummer with Korean lespedeza pasture, produced an average of 107.9 pounds of gain per acre. Unsupplemented bluegrass pasture, when grazed in rotation, produced only 71.8 pounds and when continuously grazed, only 64.2 pounds. The average gain per head was 70.6 percent more on the bluegrass with lespedeza supplement than on the other two pastures.

In pasture-improvement experiments at the Iberia Livestock Experiment Farm, in cooperation with the Bureau of Plant Industry for 5 years, steer gains were largest when a complete fertilizer was used at an average rate of 350 pounds per acre. Gains were 335 pounds per acre when the land was fertilized with ground oystershell, nitrogen, and phosphate, 303 when fertilized with ground oystershell and phosphorus, and 293 when phosphorus only was applied. Although only 175 pounds of gain per acre resulted when basic slag was used, steer gains steadily increased in the last 3 years under this treatment, whereas they decreased somewhat under the other forms of fertilization.

Grazing experiments at Tifton, Ga., in cooperation with the Bureau of Plant Industry, the Georgia Coastal Plain Experiment Station, and the Georgia Experiment Station, were conducted. A mixture of carpet grass, Dallis grass, lespedeza, and white clover

on lowland permanent pasture under different kinds of fertilization resulted in the largest steer gains when the pasture was treated with fertilizers containing phosphorus and nitrogen. These gains were 246 pounds per steer, or 369 pounds per acre, when the pasture was grazed at the rate of three steers to 2 acres. Gains of steers on pasture treated with a complete fertilizer and grazed at the same rate were only 218 pounds per head, or 327 pounds per acre. Gains of steers on pastures treated with only nitrogen or potassium fertilizers and grazed at the rate of approximately one head to an acre were much less satisfactory. Steers grazed at the rate of five head to 6 acres of unfertilized carpet grass pasture made the least satisfactory gains, which were only 56 pounds per head, or 47 pounds per acre. Over a 7-year period, however, gains were greatest on pastures treated with a complete fertilizer, although they were nearly as great when fertilizers containing phosphorus and nitrogen were used. Applications of fertilizers containing either nitrogen or potassium resulted in one-third less gains than the application of phosphorus and nitrogen.

At the same station steers grazing upland permanent pasture, consisting of a mixture of Bermuda grass and common lespedeza treated with complete fertilizer, gained 195 pounds per head, or 156 pounds per acre. These gains were 19 pounds per head, or 45 pounds per acre, more than average gains on similar but unfertilized pasture during the last 4 years.

At the Coast Experiment Station, Summerville, S. C., in cooperation with the South Carolina Agricultural Experiment Station, steer-grazing experiments were carried on to compare the beef-producing capacities of permanent pastures receiving different mineral treatments. Results were similar to those of the previous year, gains per acre being greatest on improved carpet grass and lespedeza pasture that received 1 ton of lime per acre every third year and 250 pounds of superphosphate per acre annually. These gains were 71 pounds per acre with 127 steer-days of grazing per acre. During the same period, on similar pasture receiving the same quantity of phosphorus in the form of basic slag, the gains were only 66 pounds per acre. Results with those improved pastures and native broomsedge pastures which received no fertilizer were distinctly less favorable, both in gains per acre and days of grazing.

At the same station, in cooperation with the South Carolina station, a comparison of methods of wintering steers was continued. It was found that 71 days of grazing winter rye pasture during a 120-day period replaced 1,055 pounds of corn silage in a ration including 5 pounds of oat straw and 2 pounds of cottonseed meal. Steer gains in the 120-day period averaged 41 pounds more per head than those of similar steers fed a ration of 15 pounds of sorghum silage, 5 pounds of oat straw, and 2 pounds of cottonseed meal in dry lot.

SHEEP, GOAT, AND ANIMAL-FIBER INVESTIGATIONS

Investigations in sheep and goat husbandry and in animal-fiber technology were conducted at 6 Federal stations and at farms and laboratories of 22 cooperating State experiment stations.

SHEEP-BREEDING INVESTIGATIONS

At Dubois, Idaho, the work of the Western Sheep Breeding Laboratory was begun with 765 Rambouillet ewes from flocks of the United States Sheep Experiment Station, also at Dubois. These ewes were bred to 34 Rambouillet rams, 20 of which were unrelated to the ewes. Those matings, therefore, constitute a direct outcross. This breeding program also provides for the testing of rams by means of inbreeding.

The Rambouillet inbreeding project, which was begun at the sheep station in 1927, is being continued with encouraging results. The average coefficients of inbreeding were 1.4 percent for the original ewes, and 4.4, 18.9, and 21.3 percent, respectively, for the first-, second-, and third-generation ewes. Lambs born during the fiscal year 1938 had an average coefficient of inbreeding of 21.6 percent. Only a few abnormalities, such as overshot jaws and brown or black spotting, have occurred but in no greater proportion than in less inbred Rambouillets.

The Targhee breed of sheep is being developed at Dubois, as the Bureau's interpretation of the ranchman's rather general demand for a three-fourths fine-wool breed.

A study of the production records of ewes at Dubois for the years 1933–37 shows that the Targhees excelled in lamb production, followed by Columbias, Corriedales, and Rambouillets in the order named.

In a 3-year study at Dubois, Hampshire and Suffolk rams, bred to Rambouillet and Corriedale ewes, were compared as sires of mutton lambs. For each of the 3 years all ewes and lambs were kept in one band, and the Suffolk-sired lambs were heavier at weaning time than the Hampshire-sired lambs, regardless of the breed of ewe used.

Studies were conducted at Dubois on the reproductive capacity of 89 rams, 63 of which were yearling and mature animals for use in the breeding program and 26 of which were Rambouillet ram lambs. A favorable relationship was shown between the breeding capacities of ram lambs and those of their sires.

Semen was obtained satisfactorily from rams by electrical stimulation of ejaculation. The quality of semen was approximately the same as from a normal ejaculation. This method should prove useful for obtaining semen, for artificial insemination, from rams that refuse to serve naturally and from ram lambs.

In experiments on long-distance transportation of ram semen for artificial insemination, the Bureau cooperated with the Idaho Agricultural Experiment Station by collecting semen from meritorious Southdown and Hampshire rams at Beltsville, Md., and transporting it by air and railway express to Moscow, Idaho, a distance of about 2,600 miles. At the Idaho station 60 inseminations of ewes were made with 0.2 cubic centimeter of semen per insemination. Five pregnancies resulted, and five ram lambs were produced. Seventeen of the inseminations were made with semen that was 31.5 to 48 hours old, and from these inseminations four of the five pregnancies were produced. The remaining pregnancy resulted from semen that was 72 hours old. The use of shipped semen less than 48 hours old

required 4.2 inseminations per pregnancy. In natural mating of the sheep at Beltsville during the last 10 years, the average number of services per pregnancy was 2.2.

There was completed during the year a study of the effect of type and time of birth, birth weight, and sex of lambs on survival, growth, and selection. The data were obtained from Hampshire, Shropshire, and Southdown lambs born in the Beltsville flock during a 14-year period. The study showed that single and twin lambs survived equally well to 3 months of age. No significant difference in ability to survive was found between early and late lambs, but a tendency for more of the early lambs to survive was evident. Lambs that were heavy at birth survived more often than lighter ones. Ram and ewe lambs survived equally well to 3 months of age. Single lambs were heavier than twin lambs at birth, and up to 12 months of age, but the differences at 12 months were proportionately less than at 6 months and were significant in only two of the six groups. Early lambs grew more rapidly to 3 months of age than late lambs. Differences due to time of birth tended to disappear as the animals matured. Lambs that were heavy at birth also tended to be heavier at 3 months, but the difference disappeared as the animals matured. For the most part, ram lambs were heavier than ewes at birth and to the age of 12 months.

At Beltsville, in cooperation with the Bureau of Biological Survey, the Bureau continued to apply the recently developed system of evaluating the fur of Karakul lambskins as an important means of measuring the progress of the Karakul sheep-breeding investigations. Thirty purebred Karakul lambs were produced that graded an average of 6.9 in the 10-point desirability scale. In this scale 1 is the grade most nearly perfect and 10 is the most inferior. The fur of the lambs from the Karakul × Black-faced Highland backcrosses to Karakul sires also averaged 6.9 in desirability. These backcross lambs ranged from the second to the sixth cross, averaging an inheritance of about 88 percent Karakul. Among the Karakul × Corriedale lambs produced, the crosses ranged from second to fifth cross and their fur graded an average of 7.8 in desirability. Progress toward the quality of the lambskins of the purebred Karakuls has been less rapid in the Karakul × Corriedales than in the Karakul × Black-faced Highlands. As in the mutton breeds, a program of line breeding is being established with the Karakuls in an effort to reduce genetic variability.

At Middlebury, Vt., the development of the Southdale strain of sheep from the mating of Southdown × Corriedale cross-breds has continued to make encouraging progress with respect to both quantity and quality of wool and mutton. Some of the rams were mated with native ewes in this area and have produced noticeable improvement in quality of lambs.

At Quincy, Fla., in cooperation with the Florida station, the development of a strain of sheep suitable for northern Florida and similar territory is being accomplished. As foundation stock, native Florida ewes were mated with Columbia rams and the cross-bred ewes are being mated with the cross-bred rams. The results are encouraging. In the first year of the experiment, the original native ewes of this flock produced fleeces that averaged only 2.32 pounds in a year's growth. In the present fiscal year the progeny of the Co-

lumbia rams and native ewes produced fleeces that averaged 10.62 pounds in a year's growth. One of the mature Columbia rams in this experiment in Florida produced a fleece of exactly one year's growth that weighed 24.2 pounds, which compares favorably with his wool production at the United States Sheep Experiment Station, Dubois, Idaho, where he was developed.

SHEEP-FEEDING INVESTIGATIONS

Soybean silage preserved with condensed whey was fed successfully to yearling rams, as shown by a comparison of feeding similar lambs on corn silage. The use of a relatively high proportion of condensed whey in the silage appears to preserve the forage and to add appreciable feed value.

At Beltsville, to determine efficiency of feed utilization, 15 pairs of twin lambs were fed individually for 100 days, 1 member of each pair receiving one and one-fourth times its maintenance requirement and the other being fed all that it would clean up readily. The two groups were comparable in weight at the beginning of the trial. In addition to greater consumption, there was more variability in the quantities consumed by the lambs on full feed. Gains were naturally greater in this group because of higher feed consumption, and economy of gain also was greater because more feed was consumed above the maintenance requirement.

At Newell, S. Dak., feeding experiments were conducted in cooperation with the Bureau of Plant Industry and the South Dakota station with white-faced range lambs to study rations including corn, barley, alfalfa hay, corn silage, pressed beet pulp, beet tops, molasses, and bonemeal. All lots were fed good alfalfa hay. The ration producing the cheapest gains consisted of barley, pressed beet pulp, molasses, beet tops, and alfalfa hay. Adding sugar-beet byproducts to rations of corn and alfalfa hay or barley and alfalfa hay increased their efficiency. No advantage resulted from the feeding of bonemeal.

At Dubois, ram lambs of several breeds were tested by family groups for their efficiency in the use of feed. The ration per lamb for a test period of 98 days was 1.5 pounds of whole oats, divided into two equal beedings, and all the alfalfa hay the animals would clean up. A rather wide range in efficiency of feed utilization was found, not only among the different breeds, but also among the family groups of the same breed. During the last two winters the ewe lambs at the station were fed in groups by breeds. Approximately 0.25 pound of oats and 2.5 to 3.0 pounds of alfalfa hay were fed daily per lamb. Average daily gains for the two winters were 0.189, 0.201, 0.228, and 0.195 pound for the Corriedale, Rambouillet, Columbia, and Targhee breeds, respectively. The average feed requirements per pound of grain by these breeds were 1.29, 1.21, 1.07, and 1.25 pounds of oats and 13.65, 15.08, 13.57, and 13.84 pounds of hay, respectively.

At Dubois, information is being obtained on the relative efficiency of range ewes for milk production. At lambing time each ewe is rated as good, fair, or poor on the basis of the estimated condition of the lamb and the fullness of the ewe's udder. Lambs from ewes rated as having good milk production were heaviest both at birth

and at weaning, and a higher proportion of these lambs survived to weaning than from ewes rated as having fair or poor milking ability. The percentages of ewes rated as having good milk production were as follows for the various breeds: Rambouillets, 79; Corriedales, 80; Columbias, 84; and Targhees, 87.

PASTURE AND RANGE UTILIZATION

In range-management studies at Dubois, in cooperation with the Forest Service, unregulated intensive spring grazing resulted in 32 percent less use of the range than in areas grazed in the fall only. Although the total plant cover in the two areas remained nearly the same, the plants making up the cover were very different. Intensive spring grazing reduced the number and vigor of the palatable grasses and weeds and allowed an increased production of the more inedible brush types of cover. As these increased, there was a corresponding decrease in the grasses that remain. When the same area was grazed consistently year after year during the same period, damage resulted to some of the palatable plant species. Rotation of the period at which areas are grazed offers a solution to this problem.

In these range-management studies, the burning of sagebrush on areas with a heavy cover of grasses removes the sagebrush and makes available an excellent growth of grass with a fairly good growth of edible weeds. Before burning, grass formed 28, weeds 11, and shrubs 61 percent of the original stand. After burning, grass formed 57, weeds 28, and shrubs only 15 percent of the total stand. The unpalatable sagebrush is thus largely replaced by edible grasses and weeds. This feature and the additional growth of forage on burned areas have increased the grazing capacity nearly 150 percent. Caution is necessary because burning of sagebrush on areas with a thin grass cover ordinarily has caused more damage than benefit. Also, burned-over areas should not be grazed for at least 1 year after burning lest the grasses be injured before they become fully adjusted after the fire. Crested wheatgrass (*Agropyron cristatum*) has proved to be a satisfactory grass for reseeding. It is palatable, comes early in the spring, is drought-resisting, and produces a good growth in this area.

Studies in the use of temporary pasture crops for sheep at Beltsville showed that mixed seedings of barley with either wheat or rye, sown in September, yield excellent pasture for late fall and especially early spring use. One field sown to a mixture of barley and wheat yielded 505 sheep-days of feed per acre, which is approximately 35 percent more than that generally obtained from these crops when grown alone. Areas sown separately to barley and rye yielded only 292 sheep-days of feed per acre. Soybean pasture continued to be the most dependable forage crop for summer grazing, yielding 486 sheep-days of feed per acre.

SHEEP MANAGEMENT INVESTIGATIONS

At Dubois, for the last 3 years, two tents, each 30 by 30 feet, have been used successfully as a practical shelter for range lambing. The protection afforded reduces losses during rough weather and facilitates getting lamb records. The drop band is confined in a corral adjacent to a tent. The lambs are removed to the tent as soon as

they are born. During the day, when the drop band is on the range, the lambs and their mothers are hauled to the tent in a wagon, the lambing data recorded, and, if weather is favorable, placed on the range in small groups where water and fresh feed are available. Lambs are held in the tent as a rule about 12 hours, the time depending on the weather and the rate at which the lambs are being born. The tents are moved from time to time as the ewes progress over the grazing area.

MILK-GOAT BREEDING INVESTIGATIONS

At Beltsville a study was made of the possibilities for obtaining a more uniform supply of goat's milk throughout the year by taking advantage of the tendency for some Saanen and Toggenburg does to breed earlier than the regular breeding season, September to March. Matings were attempted beginning in July and continuing into December. Results showed that matings were most successful in October with July the poorest of the months included in the study. These and previous observations indicate that a strain of milk goats that will breed earlier than the usual season may be developed through selection. As a result of the effective matings obtained, it was possible to have does freshen from January to May, or through a 4-month period, thus providing a more uniform distribution of the milk supply during the year.

A study of hermaphroditism in goats was begun. Since 1925 a large percentage of hermaphrodites have been born in the Bureau's goat herd, especially in the Saanen breed. The higher proportion of males born suggests that the hermaphrodites are genetically females, and anatomical investigations support this assumption. That there is an inherent basis for the condition is suggested by the fact that certain sires have produced a much higher percentage of hermaphrodites than have others. From the data available, hermaphroditism appears to be caused by a single recessive gene.

INVESTIGATIONS OF WOOL AND OTHER ANIMAL FIBERS

A technique for rapidly determining the fineness and variability of wool by the use of the cross-sectional method previously developed has been further improved in the animal-fiber laboratory at Beltsville. One system, in which the cross sections are projected on photostat paper, has been so perfected that it is possible to obtain a photomicrograph and accurately estimate the mean diameter and standard deviation on one sample in 15 minutes. Another system has been worked out for estimating fineness and variability by use of two film-strip projectors arranged side by side. In this system, the cross sections to be judged for fineness and uniformity are projected on a screen adjacent to standard cross sections of measured fineness and variability. Films with standard cross sections are rotated until one appears similar in fineness and variability to the one being judged. This system makes it possible to photograph and judge about 10 samples per hour.

The variability in fineness and uniformity throughout an entire lock of wool was obtained by making a cross section of the lock after it had been thoroughly carded. Variability in a composite sample consisting of several locks was found in the same manner.

To discover how the microscopically small component parts of fibers are constructed and combined, wool, mohair, human hair, cattle-tail hair, hog bristle, and desiccated connective tissue were broken down by means of acid, caustic soda, and bromine water. The difficulty experienced in controlling the breaking down of the fibers by ordinary chemical means led to a new experimental technique for this purpose. This procedure consisted in feeding the fibers to carpet beetles and examining microscopically the excreta of these insects. In both procedures the material under the microscope appears to consist of large numbers of small particles. The cortical cells are subdivided into a large number of fine fibrils, which in turn are made up of fine particles arranged in chainlike formation. The cuticle cells appear to be made up of a network of these small particles. This attempt to penetrate into the more minute structure of animal fibers is believed to underlie the solution of many problems involving variations in the qualities of these and other protein materials.

SWINE INVESTIGATIONS

BREEDING INVESTIGATIONS

At the Agricultural Research Center representatives of the Chester White, Danish Landrace, Danish Yorkshire, Duroc-Jersey, Large Black, and Poland China breeds of swine were used in the continuation of studies of the pork-producing efficiency of pigs under different systems of breeding, feeding, and management. Pigs farrowed in the spring of 1937 were weaned at 70 days of age. Pigs farrowed in the fall of 1937, unless otherwise stated, were weaned at 56 days of age. The change in weaning age from 70 to 56 days was made to conform to standards adopted in the regional swine-breeding laboratory so as to yield results comparable with data being obtained by other stations. Unless otherwise stated, all hogs used in studies involving different breeding systems were fed a standard ration from weaning to a finished weight of approximately 225 pounds.

Results of the swine performance tests again showed a wide range in size of litter farrowed, number of pigs weaned, and rate of economy of gain. Noteworthy performances were as follows:

The largest litter farrowed among the experimental animals was a fall litter of Duroc-Jersey × Yorkshire breeding. It contained 16 pigs at birth and 13 at weaning. Specimens of the Large Black breed likewise produced noteworthy litters, 4 of which averaged 12 pigs farrowed and 10.5 weaned. The largest average daily gain for any group was made by a fall litter obtained by mating Poland China × Landrace sows to Poland China boars, the gain being 1.56 pounds. One litter of Large Blacks made the creditable average daily gain of 1.54 pounds.

The litter requiring the least feed to make 100 pounds of gain was a fall litter of Duroc-Jersey × Yorkshire breeding, 333 pounds of feed being required. A spring litter of Duroc-Jersey pigs was a close second with 335 pounds of feed per 100 pounds of gain.

Breeding studies were continued at the United States Range Livestock Experiment Station in cooperation with the Montana station. Each of the litters was fed individually until weaning at 70 days of age. Three Landrace litters averaged 10.3 pigs at birth and 8.7 at weaning. Three Hampshire litters averaged 12.0 pigs at birth and

8.0 at weaning. Six litters obtained from reciprocal crosses between the two breeds averaged 9.7 pigs at birth and 8.3 at weaning. The quantity of feed consumed during the suckling period by each group of sows and their litters per 100 pounds of pigs weaned averaged 272 pounds for the Landrace breed, 281 for the Hampshire, and 305 for the cross-breds. The litter heaviest at 70 days of age, that of a Landrace sow with a cross-bred litter of 10 pigs, weighed 417 pounds at weaning.

Additional data were obtained at Beltsville on small, intermediate, and large types of Poland China hogs. Both spring and fall litters were obtained for the three types, and all pigs were weaned at 70 days of age. As in the previous year, all hogs were fed to the same degree of finish, the small type averaging 141 pounds when slaughtered, the intermediate type 211, and the large type 255. The average daily rates of gain were 0.88, 1.22, and 1.21 pounds, respectively, for the three types. Feed requirements to final weights were 404, 403, and 413 pounds per 100 pounds of gain.

Studies conducted in cooperation with the Georgia Coastal Plain Experiment Station at Tifton, were continued to develop strains of Duroc-Jersey hogs superior in type and conformation, high in fertility, and efficient in production. Fifteen spring and seventeen fall litters averaged 9.9 pigs at birth and 7.1 at weaning. The average weight at weaning age of 70 days was 31.8 pounds for both spring and fall pigs. The fall pigs were sired by four different males. When the animals were grouped according to sires and fed to approximately 200 pounds of final weight on shelled corn and protein supplement on green oats pasture, no appreciable differences were found in feed requirements, which ranged from 388 to 404 pounds per 100 pounds of gain. Rate of gain varied from 1.2 to 1.4 pounds daily.

Studies were continued in cooperation with the medical school of Johns Hopkins University on the physiology of blood formation in swine. A phase of this work involved physiological observations of animals in which a condition similar to pernicious anemia in pigs had been produced experimentally by gradually reducing the quantity of yeast in a synthetic diet. As a result, the pigs ceased to grow and their hair became dull and matted. The administration of synthetic vitamin B_1 and riboflavin permitted somewhat better growth, but the general condition of the animals improved very little. Marked incoordination of gait developed. Examination of the nervous system of the animals after autopsy revealed a severe degeneration, particularly in posterior columns of the spinal cord.

In cooperation with the Missouri station, a study of the anatomy and physiology of the reproductive organs from 13 yearling boars showed that about 15 to 25 percent of the semen originates in the seminal vesicles, which supply most of the potassium, phosphorus, total nitrogen, and all the glucose in the semen. Cowper's glands contribute about 10 to 20 percent of the semen, their secretion being rich in sodium, calcium, magnesium, and nitrogen. Prostatic and urethral secretions are the source of most of the chlorides in semen and contribute 55 to 70 percent of its volume. Epididymal fluid, which is rich in phosphorus and total nitrogen, contains about 5,000,000 sperms per cubic millimeter and supplies 2 to 5 percent of the semen. The volume of semen normally ejaculated varies from 125 to 500 cubic centimeters and the number of sperms ranges from 5 to 300

billion per ejaculate. Removal of the accessory sex glands does not appear to affect sexual desire or reduce fertility. Regeneration of tissue has not been observed to occur after the removal of the accessory glands.

At the regional swine-breeding laboratory at Ames, Iowa, established during the last fiscal year for the improvement of swine through breeding, data are being accumulated on the effect of different systems of breeding, such as cross-breeding and moderate and intensive inbreeding, on growth and development, and on the inheritance of various characters. The State agricultural experiment stations of Iowa, Minnesota, Missouri, Nebraska, and Oklahoma are actively cooperating in the project.

FEEDING INVESTIGATIONS

Studies were continued at Beltsville on the effect of supplementary feeding of protein-rich feeds to pigs 3 weeks of age at the beginning of the experiment and fed for 11 weeks. Three groups of sows and litters, including both spring- and fall-farrowed pigs, were tested. All groups had free access to self-feeders containing a standard ration. In addition to this ration, the pigs in one group had free access to skim milk placed in a creep and another group had tankage in a creep. The remaining group was used as controls. At weaning, the pigs receiving skim milk were heaviest in weight, those receiving tankage were next, and the controls were lightest. From weaning to final feed-lot weights the average daily gains per pig were 1.52, 1.40, and 1.37 pounds, respectively, for the groups receiving skim milk, tankage, and no supplement, and the feed requirements per 100 pounds of gain were 343, 353, and 358 pounds, respectively. On the average, pigs receiving skim milk reached final feed-lot weight 2 weeks earlier than those in the other groups. These results confirm those of earlier tests and indicate the value of skim milk for maximum growth and economic gains during the suckling and growing periods.

Five lots of 10 pigs each with initial weights of approximately 60 pounds were self-fed in dry lot to individual weights of approximately 225 pounds. One lot (a control) received a ration of tankage, linseed meal, and corn. In the rations of the remaining four lots, 5, 10, 15, and 20 percent of ground alfalfa hay replaced part of the tankage and corn. When the current year's results are combined with those of the previous year, in which pigs of 45 pounds' initial weight and fed similar rations were used, the average daily gains were 1.55, 1.66, 1.71, 1.61, and 1.49 pounds and the feed requirements per 100 pounds of gain were 357, 374, 376, 393, and 404 pounds, respectively, for the control lot and those receiving the 5, 10, 15, and 20 percent of ground alfalfa hay. These results indicate that at least as much as 20 percent of a well-balanced ration for growing and fattening hogs may consist of ground alfalfa hay, thereby lessening the need for using concentrated feeds. In addition, the use of alfalfa hay in the winter swine ration helps to supply health-giving nutrients that might otherwise be lacking at this season of the year.

Results of tests in which grass silage was preserved with concentrated whey indicate that it can be used successfully as a supplement

in the winter ration for growing and fattening pigs. In cooperation with the Bureau of Dairy Industry, a winter-feeding test was conducted with concentrated whey-treated grass silage in comparison with corn silage and ground alfalfa hay. Four lots of 10 pigs each were self-fed a standard ration. One lot, used as controls, received this ration supplemented with ground alfalfa hay; a second lot, with corn silage; a third, with concentrated-whey grass silage; and the fourth, with concentrated-whey grass silage and 2 pounds of concentrated whey per 100 pounds of live weight. The corn silage and whey-treated grass silage constituted 13.6 percent of the ration and ground alfalfa hay 5 percent. The pigs averaged approximately 65 pounds of initial weight and were fed to a final weight of approximately 225 pounds. They gained at the rate of 1.83, 1.48, 1.78, and 1.81 pounds per pig daily, and required 357, 422, 411, and 398 pounds of feed, respectively, on the rations in the order given.

MANAGEMENT INVESTIGATIONS

A study was made of the records on 658 sows for the years 1927 to 1935, inclusive, to determine the effect, on sows and litters, of weight changes in sows during the gestation and suckling periods. The results indicate that there was a tendency toward larger and heavier litters with increased rate of gain of sows during gestation. As the sows' daily rate of gain increased during gestation there was an increasingly greater loss in their weight while suckling their pigs. Over the 9-year period, sows that farrowed in the spring showed significantly greater losses than those that farrowed in the fall. These results suggest that caution should be exercised in culling sows from the herd at weaning time, since the sows possessing genes for large litters with accompanying high milk production might be discarded due to their thinness and very poor appearance at that time.

HORSE AND MULE INVESTIGATIONS

Breeding, feeding, and management studies with light horses were continued at the United States Morgan Horse Farm. Morgan sire-line breeding from selective matings produced an outstanding, straight-bred stallion, Goldfield, a young sire of excellent type and conformation that will be proved in sire-line breeding and performance. Further improvements in type and saddle conformation, especially in withers and top line, are being sought by means of a cross of American Saddle horse with Morgan inheritance on several good Morgan mares at this station. The foals thus far obtained from such matings indicate some improvement in the qualities desired. The stallion, Hudson, resulting from this outcross, is heavier and taller and has larger body and bone measurements than either of the two yearling stallions of straight Morgan breeding that were retained last year.

The breeding of purebred Nonius horses at Miles City, Mont., is being continued. At the end of the fiscal year the offspring numbered three yearlings, foaled in 1937, and four mares were pregnant.

In the cross-breeding project at this station, Nonius and Thoroughbred stallions are being used with two bands of grade Thoroughbred mares. Rotations of matings are made annually. The foals from grade Thoroughbred mares mated with the Thoroughbred stal-

lion, Sunfast, show good quality, uniformity, and good conformation for saddle use but are lacking somewhat in size and ruggedness. The mating of the Nonius stallion, Shorty, with grade Thoroughbred mares produced foals with more bone and size than those produced by the Thoroughbred stallion but with a tendency to have crooked legs, round bodies, poor shoulders, and a definite lack of sharpness of withers.

Draft-horse breeding was continued at Miles City with a purebred Belgian stallion, Purdue's Plato, and 17 purebred and grade Belgian mares. The grade Belgian foals are drafty and uniform in type. A similar group of purebred and grade Belgian mares were mated with the Nonius stallion Shorty. The group mated with the Belgian stallion this year had been mated with the Nonius stallion, Longfellow, last year. The resulting foals are of a heterogeneous type, ranging from very light to draft conformation. The foals from Nonius stallions mated with grade draft mares have not been so uniform in type as those from the Nonius stallions mated with grade Thoroughbred mares. The bay color of the Nonius stallions was dominant in all matings.

Work on physiology of reproduction with mares and stallions, which is being conducted cooperatively with the Missouri and Montana stations and as a part of jack-stock and mule-breeding investigations with the stations of Georgia, Mississippi, and Tennessee, was continued at the United States Range Livestock Experiment Station, Miles City, Mont., and at the Missouri station at Columbia. Observations on 46 draft mares (Belgian and grade Belgian) and 35 light mares (grade Thoroughbred) were made during the last 2 fiscal years. The average length of oestrus, or heat, for all mares was 5.5 days, with a range of 1 to 27 days. The draft mares tended to remain in heat slightly longer than the light mares. The average length of time between oestrus periods was 15.3 days, with a range of 6 to 33 days. Mares 2 and 3 years of age tended to have more irregular oestrus periods than older animals. Some mares showed no psychological evidence of heat during the 2 years of observation, but were undergoing physiological changes and when artificially inseminated became pregnant and foaled normally. The average interval from parturition until foal heat was 7.3 days, with a range of 2 to 12 days. Some mares apparently missed foal heat and failed to come in oestrus until 29 to 30 days after foaling. Ovulation was found to occur from the first to eleventh day of oestrus, with an average of 4.8 days. The follicles ranged from 1 to 7 centimeters in diameter and usually ruptured 1 to 2 days before the end of the heat period. In some cases ovulation did not occur and the follicle was gradually resorbed.

At Columbia a more rapid chemical test for pregnancy in mares is being developed because of the longer time and larger number of animals required for the biological test. Several of the more promising chemical tests, including the Cuboni and Kober tests, were tried. A modification of the Kober reaction has proved to be reliable and easy to use. Urine from 91 mares was tested by three methods: (1) The biological method, the rat being used as the test animal; (2) the Cuboni chemical method; (3) the modification of the Kober method. The results from the Cuboni technique agreed with those of the biological method in 96 percent of the cases, and results of

the modified Kober method agreed in 98 percent of the cases. The Cuboni test is less sensitive than either of the other two and occasionally gives false negative results. The modified Kober method gives excellent results but is apparently less sensitive than the biological.

A simple method was developed for the production, from pregnant mare's serum, of concentrated gonadotropic hormone, completely soluble in water and very active biologically. The active fraction from 50 cubic centimeters of pregnant mare's serum, when dissolved in 50 cubic centimeters of water, gives a positive response in the rat with dosages as small as 0.025 cubic centimeter. It was found that 1 milligram of the active fraction is equivalent to 17 rat units.

Data obtained and compiled by the Bureau on the numbers of public-service stallions and jacks licensed during 1935–37 in the States having enrollment laws show increases over the numbers of such sires licensed in the preceding 3-year period, 1932–34. In 1937, the 22 States having stallion-enrollment laws licensed 16,228 stallions, of which 11,209 were purebred, and the 20 States with jack-enrollment laws licensed 1,455 jacks, 537 of which were purebred. In 1934, the same States licensed 13,753 stallions and 1,359 jacks for public service, there being 9,666 purebred stallions and 579 purebred jacks.

CERTIFICATION OF ANIMALS IMPORTED FOR BREEDING

Under the provisions of paragraph 1606 of the Tariff Act of 1930, certificates of pure breeding were issued for 15,381 breeding animals imported during the fiscal year. Following are the total importations by classes and breeds during this year:

Cattle:	*Number*
Aberdeen Angus	590
Ayrshire	1,616
Brown Swiss	30
Canadian	62
Guernsey	208
Hereford	1,686
Holstein-Friesian	6,005
Jersey	769
Kerry	1
Red Poll	26
Shorthorn	586
Total	11,579

Horses:	
American Saddle	2
Arabian	5
Belgian	254
Cleveland Bay	7
Clydesdale	53
Hackney	12
Percheron	74
Shetland Pony	5
Shire	3
Standardbred	9
Suffolk	27
Thoroughbred	93
Welsh Pony	15
Total	557

Sheep:	*Number*
Cheviot	2
Cotswold	138
Dorset Horn	8
Hampshire	84
Kent or Romney March	1
Leicester	4
Lincoln	164
Oxford Down	44
Shropshire	101
Southdown	617
Suffolk	956
Total	2,119

Goats:	
Nubian	1
Saanen	1
Total	2

Swine:	
Berkshire	11
Tamworth	1
Yorkshire	43
Total	55

Cats: All breeds	12
Dogs: All breeds	1,057

There was a decrease of approximately 4 percent in the total importation of livestock during this period as compared with the importations for the previous fiscal year.

POULTRY INVESTIGATIONS

POULTRY BREEDING

In further experiments on the sex identification of baby chicks, it was found that sex of day-old Barred Plymouth Rock chicks could be determined from the down and shank color with an accuracy of about 92 percent. The male chicks usually had less intense black down color and less intense black pigment in the shank than the female chicks.

In a study of sex identification of day-old chicks from red-splashed white stock (obtained from stock that were mutants from Rhode Island Reds), it was found that among the pure-white day-old chicks there were about three times as many males as females. Among the white chicks with one red spot on the head there was an equality of sexes, and among the white chicks with two or more red spots on the head there were about twice as many females as males. In the white chicks with both red and black head spots, there were about three and one-half times as many females as males.

In a study of the inheritance of white plumage color, the white plumage of the White Silky chickens used in the experiment was shown to be inherited in the same manner as the white plumage of White Plymouth Rocks and White Wyandottes.

In a 4-year experiment, improvement of egg weight in Single-Comb White Leghorn pullets was accomplished by progeny selection and breeding. The average egg weight was steadily increased each year from 23.2 ounces per dozen in 1934 to 24.5 ounces per dozen in 1937. The selection of males used in the breeding pen the first year was made on the basis of their sisters' average egg weight, and those used in subsequent years were selected on both their sisters' and their daughters' average egg weight.

A continuation of cross-breeding investigations with White Leghorns and Rhode Island Reds shows that different strains of the same varieties of chickens may produce different results in the cross-bred progeny obtained, that the cross-breds had considerably greater incidence of broodiness than either the White Leghorns or Rhode Island Reds, and that the egg production of this year's progeny was lower than that of the first year's cross-breds.

In experiments on egg quality, continued progress is being made in breeding a line of hens that lay eggs with a high percentage of thick albumen. This year one line produced eggs that averaged 68.8 percent of thick albumen, which was 4.6 percent more than was produced by the high line last year. On the other hand, another line of birds produced eggs that averaged 45 percent of thick albumen.

POULTRY INCUBATION AND PHYSIOLOGY

By the use of commercial candling machines equipped with a blue-green glass light filter, it was possible to determine the fertility of both white- and brown-shelled eggs with an accuracy of approximately 95 percent after only 16 to 20 hours of incubation or pre-

heating at incubation temperature. Infertile eggs incubated for 18 hours at a temperature of 100° F. contained an average of approximately 15 percent less thick albumen than infertile eggs of the same age that had been stored in a refrigerator for 18 hours at a temperature of 35°. This finding shows that incubation even for a short time lowers the quality of the albumen. The candling of fertile eggs after 18 hours of incubation did not decrease their hatchability but merely delayed the hatch by 6 to 8 hours.

Experiments in artificial insemination of chickens showed that although the use of 0.1 cubic centimeter of semen per week is the best practical procedure for obtaining 80 to 90 percent of fertility, 0.05 cubic centimeter once a week or 0.1 cubic centimeter once in 10 days will produce equally good fertility among matings that normally give high fertility.

Hens that were not broody during their first laying year became broody in their second year when subjected to an environment conducive to broodiness, such as darkness, high temperature, and the presence of baby chicks.

Baby chicks were used successfully as test objects for the biological assay of gonadotropic hormone.

POULTRY FEEDING

A further study of the effect of fattening at different ages on the composition of cockerels showed that the absolute gain in live weight increased with age but that the relative gain decreased. The feed required per unit of gain in live weight increased with age. When the birds were fattened, the percentage of breast muscle and leg muscle decreased but the percentage of the remaining edible portion increased. The fat increased in all the edible portions during fattening, but the greatest quantity of new fat was found in the edible portions other than the breast and leg muscles. Fattening resulted in a decrease in the percentage of protein, ash, and water in the leg muscle but not in the breast muscle. The combined increase in fat and water during fattening was between 85 and 92 percent of the gain in the total edible portion. In the younger birds the increase in water was greater than that of fat but in birds of 20 weeks of age the reverse was true.

The feeding of charcoal, bone char, activated charcoal, and Lloyd's reagent to laying chickens had no marked effect on the color of the yolks of their eggs. Graded quantities of yellow corn had essentially the same effect on the hue, brilliance, and chroma of the color of the yolks as did graded quantities of pure leaf xanthophyll. When highly pigmented feeding stuffs, such as chili and pimiento peppers, were fed, the color in the yolks reached the maximum value after about five eggs were laid. It was concluded that those carotinoid pigments that contain one, two, or possibly three hydroxyl groups are readily transferred from the feed to the yolks of the eggs.

In a continuation of the studies of the effect of diet on hatchability, indications were obtained that expeller process soybean meal made from the Illini soybean is deficient in some factor necessary for hatchability. When this soybean meal was fed as the sole protein concentrate at a level of 20 percent, very low winter hatchability

was observed. Direct sunlight increased the hatchability of the eggs laid by the birds that received the soybean meal, even though there was an adequate supply of vitamin D in the diet. Egg production was similarly affected.

A study of the relative value of cod-liver oil and of ultra-violet irradiation as sources of vitamin D showed that 2 percent of the former in the diet was superior to 15 minutes daily of the latter. More feed was consumed per bird when the diet contained cod-liver oil than when the birds were irradiated, but less feed was required for each dozen eggs produced. A mixture of irradiated ergosterol and cod-liver oil was found not to be superior to the cod-liver oil when it was fed as the only source of vitamin D. The earlier findings that an excess of vitamin has a deleterious effect on egg production and hatchability were verified.

A satisfactory basal diet was developed for studying the vitamin A potency of alfalfa products with baby chicks. In experiments with this diet, it was found that the vitamin A potency of alfalfa leaf meals varies greatly and that there is as much variability within a given type as among different types. It was concluded that it is unwise to depend on less than 5 percent of an alfalfa leaf meal of unknown potency to supply all or most of the vitamin A required by growing chicks. A caseous deposit was found in the bursa of Fabricius in approximately 52 percent of the chicks that died after being fed vitamin A-deficient diets. Retention cysts were found in about one-third of these chicks. All but about 4 percent of the chicks with a retention cyst had a deposit in the bursa of Fabricius.

In a comprehensive study of the heat production and gaseous metabolism of male Rhode Island Red chickens from 4 to 133 days old, it was found that the basal energy metabolism per gram of live weight, after 66 hours of fasting, is greatest at the age of about 15 days or when the weight, after fasting, is about 70 grams. Thereafter, the basal metabolism decreases fairly rapidly until it becomes relatively constant at an age of about 100 days or at an average weight, after fasting, of about 980 grams. The basal respiratory quotient was found to be nearly the same at all ages studied. A definite diurnal rhythm of the energy metabolism was demonstrated. The peak of the metabolism occurred at about 8 a. m. and the lowest point at about 8 p. m.

The feeding of a vitamin A-deficient diet, which contained only about 10 International Units of vitamin A per 100 grams, had no effect on the semen production of cross-bred cockerels. As a matter of fact, after 2 months of the diet the semen production was somewhat greater than that of cockerels on a vitamin A-adequate diet that supplied about 1,900 International Units of vitamin A per 100 grams.

TURKEY INVESTIGATIONS

The sex of turkeys of any age from the time of hatching to maturity was successfully identified by observation of the male sex organs. The presence of papillae in day-old poults identifies the male and their absence identifies the female. In the typical male poult there are two papillae, which are not present in typical female poults. As the birds near sexual maturity, the male organs change

to the characteristic grooved erectile organ, whereas in the female there is practically no change.

Considerable progress was made in breeding for a small type of white turkeys that will have compact bodies, short legs, long keel bones, abundance of meat on breasts, good egg production, early maturity, and in which the live weight of the young toms will be from 13 to 17 pounds and the young hens 8 to 11 pounds at 24 to 28 weeks of age. A number of desirable families were produced and mated during the year.

Data on 4,341 eggs from 156 small-type turkey females of different varieties and crosses were analyzed for hatchability and egg weight. The average egg weight was 77.4 grams and the average hatachability was 79.1 percent of fertile eggs set. In general, eggs averaging 73 to 84 grams in weight had a higher hatchability than eggs averaging less than 73 or more than 84 grams. Among eggs from the same female, those lighter than the average weight of eggs for that female had lower hatchability than eggs heavier than the average.

NATIONAL POULTRY IMPROVEMENT PLAN

During the third year of the National Poultry Improvement Plan breeders, hatcherymen, and flock owners in 42 States participated in one or more phases of the plan. The work involved 1,478 breeders and commercial hatcheries, with a hatching capacity of more than 60,500,000 eggs. This figure represents 26.6 percent of the estimated capacity of the hatcheries of those States that are operating under the plan and is an increase of about 15 percent over the capacity of participating hatcheries last year. Hatching eggs were furnished by 28,820 flock owners who had 5,948,498 breeding birds that met the minimum requirements for their particular breeding stage and pullorum-control class.

There were in the plan, during the year, 353 United States Record of Performance flocks with a total of 108,183 females entered as U. S. R. O. P. candidates. U. S. R. O. P breeders had a total of 1,966 U. S. R. O. P. breeding pens with 26,135 females mated to U. S. R. O. P. males for the production of pedigreed chicks. A total of 182 hatcheries with a capacity of 5,323,800 eggs were able to have all their flocks mated to U. S. R. O. P. males for the production of U. S. Certified chicks.

Improvement in the organization and administration of the plan was noted in each of the 42 participating States.

BIOCHEMIC DIVISION

Much of the work of the Biochemic Division, under the direction of Robert M. Chapin, Chief, as in the past, consisted of service to other divisions of the Bureau in such matters as the routine control of dips and disinfectants for official use, the control of pullorum-disease stained antigen, the control of preservatives in serums and viruses, the production of tuberculin and mallein for official use, and the production of anti-hog-cholera serum for use on Bureau farms. Certain other activities need special mention:

HOG-CHOLERA INVESTIGATIONS

The routine production and testing of crystal-violet vaccine against hog cholera proceeded, as last year, without deficiency in potency being found in any lot prepared. Special attention was given to the efficacy of the vaccine on suckling pigs in four age groups. Pigs 7 weeks old or less were vaccinated in eight farm herds during the last 2 years. In no herd was the degree of immunity satisfactory. However, only one herd, comprising 6-week-old pigs, was known to be from susceptible sows. Eight-week-old pigs were treated in three farm herds. In one herd, from susceptible sows, the results were excellent. In a second herd, from sows that had been immunized by the simultaneous method, one pig died when tested with virus, but the remaining four showed an excellent degree of immunity. In the third herd, from sows of unknown immunity, several pigs showed severe reactions when tested with virus. Nine-week-old pigs were treated in several litters maintained on the premises of the Division's experiment station at Ames, Iowa, during the last year. Their immunity was tested 4 to 5 months later. Of 26 pigs from immune sows, 10 showed severe reactions to the virus but recovered in good condition. Of 13 pigs from susceptible sows, only 1 showed a slight visible effect from the injection of virus. Pigs 10 weeks of age or older were treated in 23 farm herds during the last 3 years. In 19 herds the degree of immunity was found to be highly satisfactory. In one it was very unsatisfactory, for of five pigs tested with virus, three died and two showed severe reactions. The remaining three herds were partially protected, for among the 15 pigs tested—five from each herd—there were only eight severe reactions and one death. It is clear that the age of pigs at the time of vaccination is an important factor in their acquirement or retention of immunity. It is also apparent that other factors peculiar to the herd or to the individual pig play an important part in determining the degree or duration of immunity. In the herds that showed highly satisfactory immunity, the interval between vaccination and test of immunity was 6 months in two herds, 7 months in two herds, 8 months in one herd, and 9 months in one herd.

A patent, assigned to the Secretary of Agriculture, was obtained on crystal-violet vaccine against hog cholera.

Owing to the economic importance of producing a vaccine of maximal possible potency per unit of virus blood, experiments on the effect of various chemical and physical factors on potency were carried out. Phenolated virus, adjusted to various hydrogen-ion concentrations and held at room temperature until it had become avirulent, displayed highest antigenic potency at pH 4.3 to 6.0 The product clearly deteriorated in potency when held at 37.5° C. for 2 additional weeks. In contrast, a subsample of crystal-violet vaccine that had been heated at 50° C. for 2 weeks seemed to be practically equal in potency to the original material in parallel tests with small doses. Crystal-violet vaccine in doses as high as 30 cc seems to have no toxic effects on pigs. It appears to stimulate some degree of leucocytosis observable within 3 days.

The potency of anti-hog-cholera serum was found to be maximally retained at hydrogen-ion concentrations between pH 5 and 8.

A claim that tomatoes in the feed are remedial against hog cholera was investigated. Liberal quantities of tomatoes were fed for 6 days, after which the pigs were exposed to hog cholera by virus injection and tomatoes were thereafter fed daily. No mitigation of the incidence, progress, or outcome of the disease was observed.

DISINFECTANTS AND ANTHELMINTICS

In completion of experiments on the preservation of clarified serum from hog blood, described in the report of last year, a subsample of each preserved serum was experimentally contaminated with about 250,000 micro-organisms (mixed cultures of *Staphylococcus aureus*, *Salmonella suipestifer*, and *Escherichia coli*) per cubic centimeter after 24 months of storage under refrigeration. The results were similar to those reported last year after 11½ months of storage, except that phenol, 0.5 percent, proved to be slowly effective in this test.

Preliminary experiments on the possible value of benzylphenol as a disinfectant against tuberculosis were completed. The bactericidal action of a commercial mixture of isomeric benzylphenols was tested in the presence of 50 percent of separated milk, with an exposure period of 2 minutes at about 25° C. Under these conditions the material was effective in 0.5-percent solution when dissolved as a sodium salt but was not effective at that concentration when brought into solution with three times its weight of either sulphonated castor-oil or coconut-oil soap.

Preliminary experiments in cooperation with the Zoological Division indicate that a practical method for the treatment of gapeworms in poultry and turkeys may have been found. Following the observation that antimony compounds seem to be specifically toxic to gapeworms, a search was made for the most suitable compound for application as a dust to be inhaled by the fowls. Obviously, the material must be a very fine noncoherent powder of high floatability in air, not significantly toxic to fowls, and of reasonable cost. Several double tartrates of antimony and certain other metals offer promise. Barium antimonyl tartrate appears to be especially suitable for use on chickens. (See Zoological Division.)

MEAT FOOD PRODUCTS

The comparative nutritive values of refined steam lard, leaf lard, neutral lard, hydrogenated lard, oleo oil, peanut oil, refined cottonseed oil, and hydrogenated cottonseed oil were determined. Fats of known origin and method of manufacture were mixed in several proportions with fat-free but otherwise adequate basal diets. The diets were fed to albino rats for 60 days, and meanwhile digestion tests, corrected for metabolic fat, were conducted with each diet. The results indicate that, for rats at least, the nutritive values of different fats can properly be compared only when each fat constitutes the same proportion of the diet and when the experiments are conducted for the same length of time. Considerable differences were found between the growth-promoting properties as well as between the digestive coefficients of some of the fats. In general, but with a few important exceptions, there was a fairly close parallelism between the di-

gestibility of a fat and its growth-promoting properties. Some fats were utilized best when fat constituted only 5 percent of the diet; others when the diet contained 55 percent of fat. Rats made excellent growth and utilized their feed very efficiently when the diets contained a high proportion of fat and no carbohydrate.

No consistent relation was observed between any chemical constituent or constant of a fat and either its digestibility or growth-promoting properties. Although several fats contained only small proportions of linoleic acid, in only one or two cases could the nutritive value be correlated with this factor. The melting points of the fats were without significance for either digestibility or growth-promoting value. In general, refined lard, peanut oil, and refined cottonseed oil were found to have higher nutritive values, and hydrogenated lard, hydrogenated cottonseed oil, and oleo oil lower values, than leaf lard and neutral lard.

TUBERCULIN

A fairly extensive field investigation of the relative potencies of avian tuberculin derived from beef-infusion medium and synthetic medium was completed. Companion vials of the two tuberculins, labeled only with key numbers, were sent to field officials with instructions to make injections from one vial into the left wattle, and from the other vial into the right wattle, of each fowl. Also, for check purposes, other pairs of vials that contained only an identical tuberculin were sent to certain inspectors. The reports indicated that considerable care and skill are required to inject tuberculin intradermically into the wattle of a fowl at precisely the right depth to produce a maximum reaction. After due allowance for irregularities in technique it appeared that tuberculin derived from the synthetic medium is at least as potent and reliable as that derived from the beef-infusion medium. The synthetic medium now is exclusively employed for the routine production of both avian and mammalian tuberculin.

In continuation of work on the availability of nitrogen from different sources for growth of the human type of the tuberculosis organism, it was found that glycylglycine afforded abundant growth, slightly better than glycine. Ammonium fumarate in not too great excess, ammonium succinate, and aminoproprionic acid all gave good growth. Ammonium pyruvate gave slight growth, but ammonium gluconate, aminobutyric acid, aminocaproic acid, and aminovaleric acid afforded very little. In general, the class of four-carbon dicarboxylic compounds appears to be particularly capable of supplying nitrogen to the organism. With an abundant supply of nitrogen from a suitable source, the growth obtained does not keep pace with the glycerin content of the medium. Analytical data indicate that glycerin is largely utilized in respiration, whereas nitrogen is utilized primarily for growth and reproduction. High nitrogen-glycerin ratios favor an increasingly alkaline reaction as growth progresses, and low ratios favor an acid reaction. However, within wide limits of proportions of nutrients, of hydrogen-ion concentrations, and of ages of cultures, the potencies of the resulting tuberculins appear to be proportional solely to the quantities of bacteria from which they are derived.

The active principle in tuberculin prepared according to the standard method of the Bureau is precipitated only in part by acetic acid. But when the mixture is further saturated with sodium chloride, the precipitation of active principle appears to be nearly as complete as when the more expensive trichloroacetic acid is used.

AGGLUTINATION ANTIGEN FOR BANG'S DISEASE

Antigens for agglutination tests for Bang's disease were supplied to the field in quantities sufficient for 3,000 whole-blood tests and 90,000 serum-plate tests. After a review of methods currently in use for the preparation of serum-plate antigen, a tentative standard method for its production, testing, and use was prepared and issued in cooperation with the Animal Disease Station and Tuberculosis Eradication Division.

The preparation of dried bovine serums for comparing the sensitivity of the agglutination antigens used in the field for the detection of Bang's disease was continued. Two series, comprising 19 serums, were sent out during the last year. When all reports on a series have been received the results are tabulated and an average titer is calculated for each serum. A memorandum of the average titers is sent to each participating laboratory, so that by comparing its own results with the averages it may be able to take necessary corrective measures. The dried serum appears to retain its titer excellently provided it is kept perfectly dry, reasonably cool, and is used shortly after it has been redissolved. Samples of these "titered serums" are sent on request to laboratories desiring to check their technique or the sensitivity of their antigens.

FIELD INSPECTION DIVISION

The Field Inspection Division, directed by S. O. Fladness, continued activities relating to the control and eradication of cattle and sheep scabies and certain other animal diseases. This Division also administered regulations designed to prevent the introduction of communicable livestock diseases of foreign origin as well as regulations governing the inspection, humane handling, and safe transport of export animals.

ERADICATION OF SCABIES

Sheep-scabies eradication was carried on in cooperation with authorities of various States. During the year 14,767,490 inspections were made and 1,235,022 dippings supervised by employees in the field. Flocks in which infection was found included 50,005 sheep, which is a slight increase over the previous year. Except for the reappearance of the disease in northern New Mexico and western South Dakota, all the range areas remained free. Many cases continued to appear in the midwestern farm region, particularly in Iowa and eastern South Dakota. Eradication work was prosecuted vigorously in those States, and substantial progress was made toward elimination of the disease. Further satisfactory progress was made in Ohio. Some scattered infection was disclosed in various other Midwestern States.

In cooperative cattle-scabies eradication work considerable progress was made in Nebraska, where the greater part of the remaining infection existed. Outbreaks of the disease in Oklahoma and Colorado were promptly eradicated. Several cases of sarcoptic scabies in Texas and Wyoming also were eliminated. At the close of the year psoroptic scabies was known to exist only in Nebraska, Kansas, and one county in New Mexico. During the year 2,602,149 inspections were made in the field, and supervised dippings numbered 455,906. Infection was found in 351 herds containing 192,873 cattle.

In the district of Texas where scabies among goats has existed, infection was found in only 2 herds containing 1,853 head. The total number inspected was 189,999.

It is believed that scabies of horses, formerly present in Montana, has been entirely eliminated.

ERADICATION OF DOURINE

State authorities continued to maintain the previously infected dourine area under quarantine, and a number of horses shipped from that area were tested. The fact that only one horse gave a positive reaction indicates that the remaining infection is slight.

CONTROL OF ANTHRAX

In Nebraska and South Dakota a large force of Bureau employees was assigned to assist State and local authorities in checking serious outbreaks of anthrax and to prevent recurrence. Death losses were negligible among Indian-owned cattle on reservations in the infected areas where assistance has been rendered by Bureau veterinarians during the last several years in administering preventive treatment. These protective measures were repeated this year and at the request of the officials of the Indian Service were extended to other reservations.

INSPECTION OF HORSES FOR INTERSTATE SHIPMENT

Bureau veterinarians inspected 1,657 horses and mules for interstate shipment in connection with their regular duties. Of these, 595 were subjected to the mallein test for glanders with negative results.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS

In accordance with regulations of the Department careful inspection was made of all horses, ruminants, and swine at the time they were presented for inspection at coast and border ports of entry. The importation of domestic ruminants and swine from countries in which foot-and-mouth disease is known to exist is prohibited by law. Because of the prevalence of this infection in many parts of the world, there were only a few countries from which animals of these kinds could be imported. Canada and Mexico were the chief sources of supply. The importation of purebred cattle from the Channel Islands was materially less than that of last year owing to an outbreak of foot-and-mouth disease there just before the spring shipments were to have begun. The number and kind of

animals imported during the year are shown in table 1. Inspections of a small number of domestic fowls and pigeons were also made at ports of entry.

TABLE 1.—*Animals inspected for importation, fiscal year 1938*

Port of entry	Cattle	Swine	Sheep	Goats	Horses and mules	Asses	Other animals
Baltimore							18
Boston					62		5
Honolulu, Hawaii							1
Houston					1		
Los Angeles					5		2
Miami					28		
New Orleans					1		
New York	233			3	785	10	102
Port Everglades					14		
San Francisco					20		
San Juan, P. R.	1,537	84		5	13	6	9
Canadian border ports	207,513	28,315	3,664	74	8,595	26	135
Mexican border ports	248,544	27	5,161	11	9,170	421	90
Total	457,827	28,426	8,825	93	[1] 18,694	463	362
Held in quarantine	233			3	52	1	110
Refused entry—							
From Mexico [2]	7,592				150		4
From Canada	70	1					
From Virgin Islands [2]	121						
Under bond for reexport	10,955	25	253		75		

[1] Of this number 1,180 were mules. [2] Owing to tick infestation.

Inspectors of the Bureau, in cooperation with the Bureau of Biological Survey, inspected and quarantined at time of entry 79,465 quail imported from Mexico.

The Bureau received excellent cooperation from the Bureau of Customs and the Public Health Service in the enforcement of import regulations. Public Health Service officials at ocean ports obtained for Bureau of Animal Industry inspectors 13,581 declarations of shipmasters reporting the presence or absence on their vessels of prohibited meat, livestock, and garbage. Customs officers cooperated by preventing the landing of such products and animals. Prohibited meats were shown to be present on 4,162 vessels and prohibited livestock on 25. These animals, totaling 64, were slaughtered and the spaces occupied by them on the vessels disinfected.

CONTROL OF IMPORT ANIMAL BYPRODUCTS, HAY, AND STRAW

Regulations designed to prevent the introduction of anthrax, foot-and-mouth disease, and rinderpest, through the medium of import animal byproducts and feeding materials, were carefully administered. Tanneries and like establishments receiving restricted import products of this kind were required to provide separate storage and other facilities necessary in the disinfection of the products themselves or in the disinfection or control of the effluents incident to their processing. Cars numbering 1,139, used in the transportation of restricted import products, were disinfected, as were trucks, ship compartments, and premises involved in the handling of such products.

Uncertified hay and straw packing materials proceeding from countries where foot-and-mouth disease exists were required to be destroyed. Comparatively few exporters in foreign countries use those materials for packing in connection with shipments to the United States. Supervision was maintained over calf stomachs imported for the manufacture of rennets and over animal glands for the manufacture of biological products when originating in countries infected with foot-and-mouth disease or rinderpest. Animal manure was not allowed importation from any country without special permit.

INSPECTION AND SAFE TRANSPORT OF EXPORT ANIMALS

During the year, 7,336 animals of various kinds were inspected for exportation in compliance with Department regulations and in order to meet the requirements of receiving countries. Supervision was also maintained over the equipment of vessels carrying export animals to assure proper space and fittings for their humane treatment and safe transport. In table 2 are shown the number and kind of animals inspected for export.

TABLE 2.—*Inspection and testing of animals for export, fiscal year 1938*

Kind of animal	To Canada	To other countries	Total	Kind of animal	To Canada	To other countries	Total
Cattle	177	1,832	2,009	Mules	----	1,780	1,780
Swine	4	163	167	Asses	----	7	7
Sheep	444	877	1,321	Other animals	----	12	12
Goats	8	262	270				
Horses	264	1,506	1,770	Total	897	6,439	7,336

MEAT INSPECTION DIVISION

The activities of the Meat Inspection Division were directed during the year by E. C. Joss, Chief. Inspection of cattle, sheep, swine, and goats, and meat products thereof and, in a limited way, of horses and horse meat products, was conducted at 701 establishments located in 252 cities and towns. During the year inspection was inaugurated at 26 establishments and withdrawn from 38. The withdrawal of the inspection was made necessary on account of discontinuance of the preparation of meat and meat food products for interstate or foreign commerce. At the close of June 30, there were 663 establishments operating under inspection in 243 cities and towns. At establishments operating under this inspection, 65,970,450 animals were slaughtered and 7,505,444,990 pounds of meat and meat food products were cured, canned, chopped, rendered, refined, or otherwise prepared.

ANTE-MORTEM AND POST-MORTEM INSPECTIONS

The results of the ante-mortem and post-mortem inspections are given in tables 3 to 6, inclusive.

TABLE 3.—*Ante-mortem and post-mortem inspections of animals, fiscal year 1938*

Kind	Ante-mortem inspection				Post-mortem inspection		
	Passed	Suspected [1]	Condemned [2]	Total	Passed	Condemned [2]	Total
Cattle	9,862,689	112,654	3,425	9,978,768	9,916,904	57,370	9,974,274
Calves	5,822,094	9,260	3,125	5,834,479	5,821,179	19,995	5,841,174
Sheep and lambs	17,670,909	5,375	6,230	17,682,514	17,634,228	42,180	17,676,408
Goats	8,828	13	18	8,859	8,715	150	8,865
Swine	32,353,144	80,296	10,684	32,444,124	32,371,641	82,264	32,453,905
Horses [3]	15,780	44	16	15,840	15,684	140	15,824
Total	65,733,444	207,642	23,498	65,964,584	65,768,351	202,099	65,970,450

[1] "Suspected" is used to designate animals suspected of being affected with disease or condition that may cause condemnation in whole or part on special post-mortem inspection.
[2] For causes and additional condemnations see tables 4 to 6, inclusive.
[3] Horses are slaughtered and the meat thereof handled and prepared in establishments separate and apart from those in which cattle, calves, sheep, goats, and swine are slaughtered and the meat thereof handled and prepared.

TABLE 4.—*Number of animals condemned for various diseases and conditions on ante-mortem inspection, fiscal year 1938*

Cause of condemnation	Cattle	Calves	Sheep and lambs	Goats	Swine	Horses
Abscess					27	
Arthritis and other bone diseases	1				99	
Dropsical diseases					1	
Emaciation	14	6	8		64	
Enteritis					4	
Gangrene			2			
Hog cholera					583	
Immaturity		89				
Influenza					8	
Injuries	1	1			5	
Mastitis	6		1			
Metritis	2					
Moribund [1]	3,325	3,006	6,175	18	9,447	16
Necrobacillosis					5	
Omphalophlebitis		1				
Pericarditis	2					
Peritonitis	2				1	
Pneumonia	25	16	24		32	
Pseudoleukemia	1					
Pyemia	1	1			25	
Pyrexia	16	1	13		364	
Recent parturition					1	
Septicemia	23	4	7		17	
Tetanus	2				1	
Tumors	4					
Total	3,425	3,125	6,230	18	10,684	16

[1] Includes animals found dead in the ante-mortem pens when inspection was conducted.

TABLE 5.—*Number of carcasses condemned for various diseases and conditions on post-mortem inspection, fiscal year 1938*

Cause of condemnation	Cattle	Calves	Sheep and lambs	Goats	Swine	Horses
Actinomycosis	1,089	79			2	
Anaplasmosis	31	4				
Anthrax	1				161	
Arthritis and other bone diseases	193	345	546		6,896	
Asphyxia	5	6	11		263	
Bighead (plant poisoning)			27			
Blackleg	6	6				
Caseous lymphadenitis			6,260	8		
Cellulitis					8	
Contamination	3	2	10		1,136	
Cysticercosis	209	18	392		39	
Dropsical diseases	45	2	26		31	
Emaciation	7,524	4,021	9,545	124	244	23
Gangrene	5		4		5	1
Hog cholera					13,797	
Hydrocephalus		1				
Hydronephrosis	7	1	7		71	
Icterus	117	467	3,848	3	3,943	
Immaturity		7,270		8		
Influenza					3	
Injuries	3,846	542	1,417	1	1,433	7
Johne's disease	1					
Melanosis	50	91	96		136	37
Necrobacillosis	3				1	
Necrosis	4	1			2	
Omphalophlebitis		141				
Parasitic diseases	116	2	78		739	
Pneumonia, pleurisy, enteritis, peritonitis, etc	23,726	4,895	14,748		18,770	37
Pregnancy and recent parturition	17		59		3	
Pseudoleukemia	1,459	58	27		181	3
Septicemia and pyemia	10,492	1,921	3,532		18,416	16
Sexual odor				6	2,996	
Skin diseases	1	1			41	
Splenetic fever	1	1				
Swine erysipelas					134	
Toxemia	19	3	3			
Tuberculosis	4,512	51	18		12,423	
Tumors: carcinomata, scarcomata, etc	3,637	41	160		310	16
Uremia	220	25	1,366		80	
Xanthosis	31					
Total	57,370	19,995	42,180	150	82,264	140

TABLE 6.—*Number of parts of carcasses*[1] *condemned for various diseases and conditions on post-mortem inspection, fiscal year 1938*

Cause of condemnation	Parts of carcasses of—				
	Cattle	Calves	Sheep and lambs	Swine	Horses
Actinomycosis	220,948	8,634		1	
Arthritis and other bone diseases	21	6	18	136	11
Caseous lymphadenitis			21		
Cellulitis	12	11		1,075	
Contamination	100	870	3	1,815	
Hydrocephalus		4			
Injuries	1,638	187	195	37,269	9
Melanosis	36	79	2	3	4
Necrosis	70	4			
Parasitic diseases	8				
Tuberculosis	8,818	111		171,032	
Tumors and abscesses	14,300	4,944	90	274,840	176
Xanthosis	5				
Total	245,956	14,850	329	486,171	200

[1] In addition to the above parts, 989,318 cattle livers and 38,552 calf livers were condemned on post-mortem inspection.

INSPECTION OF MEAT AND MEAT FOOD PRODUCTS

Meat and meat food products prepared and processed under supervision are shown in table 7, which is a record only of inspection performed and not a statement of the actual quantity prepared.

TABLE 7.—*Meat and meat food products prepared and processed under supervision, fiscal year 1938*[1]

Product	Quantity	Product	Quantity
Placed in cure:	*Pounds*	Canned meat and meat food products—Continued.	*Pounds*
Beef	119, 155, 135	Soup	219, 481, 936
Pork	2, 059, 921, 408	All other	70, 171, 331
Smoked and/or dried:		Bacon, sliced	226, 537, 337
Beef	54, 101, 941	Lard:	
Pork	1, 260, 975, 889	Rendered	861, 678, 532
Sausage:		Refined	696, 874, 189
Fresh, finished	104, 737, 004	Oleo stock	116, 184, 400
Smoked and/or cooked	543, 320, 608	Edible tallow	72, 893, 240
To be dried or semidried	98, 953, 499	Compound containing animal fat	440, 808, 001
Loaf, headcheese, chili con carne, jellied products, etc	100, 205, 068	Oleomargarine containing animal fat	54, 523, 010
Cooked meat:		Miscellaneous	20, 170, 385
Beef	13, 562, 756	Horse meat:	
Pork	151, 358, 465	Cured	1, 960, 378
Canned meat and meat food products:		Ground	904, 609
Beef	81, 104, 283	Edible oil	9, 375
Pork	107, 983, 060		
Sausage	27, 869, 151	Total	[2]7, 505, 444, 990

[1] The following quantities of meat and meat food products were condemned on reinspection and destroyed for food purposes on account of having become sour, tainted, rancid, unclean, or otherwise unfit for human food: Beef, 1,423,271 pounds; pork, 3,858,422 pounds; mutton, 53,373 pounds; veal, 45,961 pounds; horse meat, 2,456 pounds; total, 5,383,483 pounds.

[2] This figure represents "inspection pounds" as some of the products may have been inspected and recorded more than once due to having been subjected to more than 1 processing treatment such as curing first and then canning.

MEAT AND MEAT FOOD PRODUCTS CERTIFIED FOR EXPORT

There were inspected and passed for export during the year the following products: Beef and beef products, 28,871,384 pounds; mutton and lamb and their products, 2,775,330 pounds; pork and pork products, 271,610,737 pounds; horse meat and its products, 1,626,689 pounds; total, 304,884,140 pounds. There were issued 28,340 official meat-inspection certificates in connection with the foregoing. There were also issued 4,099 certificates covering the exportation of 41,744,040 pounds of inedible animal products.

INSPECTION OF MEAT AND MEAT FOOD PRODUCTS WHEN OFFERED FOR ENTRY INTO THE UNITED STATES

Table 8 shows foreign meat and meat food products inspected and passed when offered for entry into the United States, with principal countries of origin and kind and quantity of products.

TABLE 8.—*Foreign meat and meat food products passed for entry, fiscal year 1938*

Country of origin	Fresh meats			Canned meats			Cured meats	
	Beef and veal	Pork	Mutton and lamb	Beef	Pork	Other	Beef	Pork
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Argentina				40,484,659	104,318	14,698	1,201	1,299,375
Brazil				29,866,231	22	88	825,685	
Canada	2,620,336	9,576,972	25,015	1,578	149	9,546	233,679	1,628,463
Czechoslovakia					370,898	22,693		
Denmark		1,448			3,189,749	232,273		337,041
Estonia					635,826	1,440		739
Germany					513,143	64,815		109,105
Great Britain					494	3,071	24	176,772
Hungary				462	3,450,458	816		8,099
Italy				203		1,859		6,832
Latvia		139,638			133,888	1,422		
Lithuania	297	1,573,390	5,247		611,761	83,096	650	68,098
Netherlands					1,635,772	34,213	4	139,841
New Zealand	775,601	1,475	2,163			1,800		447
Paraguay				2,956,580				
Poland	28,084	1,489,162			32,659,715	1,224,109		1,248,277
Rumania					1,521,380	6,573		5,402
Sweden		349,914			1,599			36,105
Uruguay				15,291,790		99	590,956	7,700
Other countries	148,653	624		28,451	222,286	114,271		190,637
Total	3,572,971	13,132,623	32,425	88,629,954	45,051,458	1,816,882	1,652,199	5,262,933

Country of origin	Sausage (not canned)	Oleo products	Edible tallow	Miscellaneous	Total
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Argentina	27,623	1,044,304	443,009	339,243	43,758,430
Brazil	5,300		224,300	24,976	30,946,602
Canada	162,310	11,435		2,837,199	17,106,682
Czechoslovakia				506	394,097
Denmark	115,974			42,626	3,919,111
Estonia	69			6	638,080
Germany	122,744			5,628	815,435
Great Britain				237,659	418,020
Hungary	31,325			115	3,491,275
Italy	493,603			1,247	503,744
Latvia	22				274,970
Lithuania				3,947	2,346,486
Netherlands	8,103			9,691	1,827,624
New Zealand				82,356	863,842
Paraguay				551	2,957,131
Poland	64,542			5,288	36,719,177
Rumania	181			4,790	1,538,326
Sweden	2,196				389,814
Uruguay		68,123		90,050	16,048,718
Other countries	2,763		11,307	130,056	849,048
Total	1,036,755	1,123,862	678,616	3,815,934	165,806,612

Table 9 shows the kind and quantity of foreign meat and meat food products refused entry or condemned on account of unsoundness, presence of prohibited preservatives, mislabeling, defective canning, or other failure to comply with the regulations.

TABLE 9.—*Foreign meat and meat food products refused entry and condemned, fiscal year 1938*

Product	Refused entry	Condemned	Product	Refused entry	Condemned
Beef:	*Pounds*	*Pounds*		*Pounds*	*Pounds*
Fresh	317	49,570	Mutton, canned	84	78
Cured		2,538	Sausage	4,068	10,659
Canned	740,027	1,045,224	Lard		463
Pork:			Miscellaneous	665	480
Fresh	602	29,714			
Cured	38,710	95,633	Total	868,002	1,522,605
Canned	83,529	288,246			

FOREIGN ANIMAL CASINGS RELEASED FOR ENTRY OR REFUSED ENTRY

Animal casings from 54 foreign countries were released for entry as follows: On certification, 12,995,119 pounds, of which 44,436 pounds were dried casings; on disinfection, 1,130,666 pounds; total, 14,125,785 pounds. Casings amounting to 5,594 pounds were refused entry and removed from the United States.

INSPECTIONS FOR OTHER AGENCIES OF THE GOVERNMENT

By request of other Government agencies, meat and meat food products were inspected for condition and conformance to specifications as shown in table 10.

TABLE 10.—*Inspections for other Government agencies,*[1] *fiscal year 1938*

Branch of Government	Passed	Rejected	Branch of Government	Passed	Rejected
	Pounds	*Pounds*		*Pounds*	*Pounds*
Navy Department	59,201,872	1,577,125	Coast Guard	622,169	17,278
Veterans' Administration (hospitals and homes)	6,227,754	183,961	War Department (Army Engineering Corps)	580,505	5,664
Department of Justice (Federal penitentiaries)	3,112,948	108,759	Maritime Commission	251,460	9,479
Marine Corps	2,823,284	57,693	Inland Waterways Corporation	154,041	21,709
Department of Interior:			Tennessee Valley Authority	107,440	507
Alaska Railroad	87,073				
Bureau of Indian Affairs	932,324	36,369	Total	74,100,870	2,018,544

[1] Not including inspections for emergency and relief agencies.

EXEMPTION FROM INSPECTION

The provisions of the meat-inspection law requiring inspection usually do not apply to animals slaughtered by farmers on farms nor to retail butchers and retail dealers supplying their customers. Farmers, retail butchers, and retail dealers, however, are required to furnish shippers' certificates, thus providing the Bureau with a record of their shipments. In addition, the retail butchers and retail dealers, in order to ship meat and meat food products in interstate or foreign commerce, are required to obtain certificates of exemption from inspection. During the year 166 of these certificates were issued and 441 canceled. The number of such certificates outstanding at the close of the year was 861.

On June 29, 1938, the Meat Inspection Act of March 4, 1907, as amended and extended, was further amended by substituting for the concluding paragraph thereof a paragraph with respect to the application of the Meat Inspection Act to farmers, retail butchers, and retail dealers. This legislation is expected to provide more effective control over meats transported in interstate trade under exemption from inspection.

During the year 92,798 shipments were made by retail butchers and retail dealers holding certificates of exemption. These shipments covered products as shown in table 11.

TABLE 11.—*Shipments by retail butchers and retail dealers under certificates of exemption, fiscal year 1938*

Product	Carcasses	Quantity	Product	Carcasses	Quantity
	Number	*Pounds*		*Number*	*Pounds*
Cattle (3,354 quarters)	838	371,014	Cured meats		1,061,790
Calves	19,696	1,417,302	Lard		40,168
Sheep and lambs	1,120	43,160	Sausage		287,021
Swine	269	25,430	Miscellaneous (headcheese, suet, scrapple, compound, etc.)		96,283
Beef, fresh		4,911,657			
Veal, fresh		707,346			
Mutton and lamb, fresh		880,264			
Pork, fresh		739,917	Total	21,923	10,581,352

During the year 61,709 interstate shipments were made of meat and meat food products from animals slaughtered by farmers on the farm. The products composing these shipments are shown in table 12.

TABLE 12.—*Shipments of farm-slaughtered meat and meat food products, fiscal year 1938*

Product	Carcasses	Quantity	Product	Carcasses	Quantity
	Number	*Pounds*		*Number*	*Pounds*
Cattle (2,674 quarters)	668	267,652	Cured meats		402,288
Calves	147,542	9,497,250	Lard		4,262
Sheep and lambs	6,243	136,087	Sausage		168,811
Swine	1,021	59,430	Miscellaneous (scrapple, headcheese, livers, souse, meat loaf, etc.		157,748
Beef, fresh		35,027			
Veal, fresh		679,179			
Mutton and lamb, fresh		2,881			
Pork, fresh		123,933	Total	155,474	11,534,593

MEAT-INSPECTION LABORATORIES

Analyses and examinations of meat and meat food products were conducted in the meat-inspection laboratories situated in the several districts throughout the country. Samples examined numbered 38,590, of which 3,586 were not in accordance with the regulations.

The principal causes for the adverse findings were excessive water in sausage, excessive fat tissue in pork sausage, failure to declare added substances, inclusion of substances not permitted in preparing meats and meat food products, and nonconformance with requirements of the meat-inspection regulations governing the importation of foreign meats. No difficulty was experienced at inspected establishments in obtaining correction of the irregularities indicated by laboratory findings.

LABELING MEAT AND MEAT FOOD PRODUCTS

During the year, 23,146 trade labels and other markings for meat and meat food products were submitted by proprietors and managers of inspected establishments, importers, and others to the Bureau for approval. Of this number 1,542 were rejected, principally on account of statements or designs that were misleading or false as to quality, quantity, ingredients, origin, or disease-preventive or curative properties of the articles to be labeled.

DRAWINGS AND SPECIFICATIONS

Eight hundred seventy-six sets of drawings and specifications of new and remodeled structures were presented by meat-packing concerns for examination and approval. The principal objectives in considering such projects are to insure (1) that the equipment is of suitable type, arranged for efficient inspection and clean handling of products and (2) that the construction is of a character that facilitates sanitation. In attaining these objectives, the cooperative spirit of the concerns presenting the plans was shown by a material increase over previous years in the proportion of plans approved.

PACKERS AND STOCKYARDS DIVISION

The work of the Packers and Stockyards Division was directed during the year by A. W. Miller, Chief. Under the Packers and Stockyards Act, the activities involved supervision over the operations and practices of packers, stockyard companies, market agencies, and dealers in connection with livestock, and of licensees in connection with live poultry, and rates and charges for services at stockyards and at designated live-poultry markets. Under the livestock quarantine laws and regulations, the activities included the inspection of all livestock received at public stockyards, enforcement of the 28-hour law, and cooperation with the various States in applying their laws and regulations designed to prevent the introduction of animal diseases.

FORMAL PROCEEDINGS UNDER THE PACKERS AND STOCKYARDS ACT

On July 1, 1937, 149 formal dockets were pending. During the year 276 new dockets were instituted and 17 were reopened. Final action was taken on 381 of these cases, and 61 were pending on June 30. Of the 276 new dockets instituted, 62 involved trade practices and reparation; 9, failure to maintain bonds; 17, insolvency; and 188, applications for poultry licenses. The 17 dockets reopened involved reasonableness of rates and poultry licenses. Cease-and-desist and suspension orders were issued in 30 dockets, suspension orders in 6, reparation orders in 4, orders prescribing reasonable rates and charges in 3, orders granting licenses in 248, orders denying licenses in 39, orders suspending licenses in 3, orders revoking licenses in 4, orders of dismissal in 42, and miscellaneous orders in 2.

CASES IN COURT PERTAINING TO THE PACKERS AND STOCKYARDS ACT

In July 1937 a statutory court of three Federal judges issued an opinion holding that the Secretary had given the livestock commis-

sion men at the stockyards in Kansas City, Mo., a full hearing and that the schedule of rates for buying and selling livestock on commission prescribed by the Secretary, after such hearing, was reasonable. The commission men appealed from this decision to the Supreme Court of the United States. On April 25, 1938, the Supreme Court delivered an opinion holding that the commission men had not been given a full hearing as required by law and that the order of the Secretary was invalid. The Government then filed a petition with the Supreme Court for rehearing. On May 31 the court denied the petition and remanded the case to the lower court for further proceedings in conformity with the opinion of the Supreme Court. In June the lower court denied a motion by the Government that sought to prevent the return of approximately $600,000 impounded with the court by the commission men during the pendency of the litigation. The court issued an order for the return of the impounded funds to the commission men and also permanently enjoined the enforcement of the rates prescribed by the Secretary. A decision as to further action in the matter by the Government was pending at the close of the year.

On October 8, 1937, a statutory court of three Federal judges delivered an opinion upholding an order of the Secretary prescribing a schedule of reasonable charges to be made by the Denver Union Stock Yard Co., Denver, Colo. The company appealed from this decision to the Supreme Court of the United States, and on May 31 that court issued an opinion affirming the judgment of the lower court. The rates prescribed by the Secretary were put into effect by the stockyard company on June 1. At the close of the year arrangements were being made by the company to return approximately $60,000 to shippers who paid charges in excess of those prescribed by the Secretary during the pendency of the litigation.

At the close of the year, a case was pending in a Federal circuit court of appeals involving an attempt on the part of the Great Atlantic & Pacific Tea Co. to have set aside a cease-and-desist order issued against it, based on violations of title II of the act.

During the year Federal district courts imposed penalties on various persons for engaging in the business of handling live poultry in commerce without having a license as required by title V of the act.

LIVE-POULTRY DEALERS AND HANDLERS

As a result of investigations and an informal hearing, St. Louis, Mo., was designated on November 19, 1937, as coming under the provisions of title V of the Packers and Stockyards Act. Investigations were being continued at other points for the purpose of determining whether they should be designated.

STOCKYARDS

On June 30, 1937, there were 140 stockyards posted as coming within the jurisdiction of the Packers and Stockyards Act. During the year 36 stockyards were posted as coming within the jurisdiction of the act, and 10 were released. At the close of the year the number of stockyards posted under the act was 166.

REGISTRATIONS

On June 30, 1938, there were 1,611 market agencies and 3,185 dealers registered to operate at posted stockyards. During the year 273 market agencies and 621 dealers were registered, and 225 market agencies and 302 dealers were placed on the inactive list.

LICENSES

During the year 889 licenses were issued under title V of the Packers and Stockyards Act and 108 were rendered inactive owing to the fact that the licensees are no longer engaged in business. Two licenses were restored and three were revoked for cause. At the close of the year 1,641 licenses were in effect at designated markets.

RATES AND CHARGES

Petitions were filed by the market agencies at the stockyards in Sioux City, Iowa, Kansas City, Mo., National Stock Yards, Ill., Denver, Colo., and Chicago, Ill., seeking modification of rates and charges prescribed by the Secretary for buying and selling livestock on a commission basis. After careful investigations by the Department, certain modifications were made in the orders of the Secretary applicable to these markets. A petition was also filed by the market agencies at the New Orleans Stock Yards, Arabi, La., seeking modification of the rates and charges prescribed by the Secretary for selling and buying livestock on commission. However, this petition was not acted on for the reason that the petitioners failed to submit the required information.

Stockyard companies located at Omaha, Nebr., Sioux City, Iowa, St. Joseph, Mo., Peoria, Ill., and Denver, Colo., also filed petitions requesting modification of the rates and charges that had been prescribed by the Secretary. These petitions were also investigated thoroughly by the Department, after which orders of modification were issued by the Secretary.

A hearing on the reasonableness of the rates and charges of the Union Stock Yard & Transit Co. of Chicago, Ill., was completed, and an examiner's report was issued. Following this action, the stockyard company filed a new schedule containing lower rates. This schedule was accepted for filing with the understanding that the time for filing exceptions to the report of the examiner would be postponed and further proceedings in the case would not be instituted except after 60 days' notice. In the meantime the stockyard company agreed that it would not file any schedules containing higher rates without submitting justification therefor.

Valuations were made of the property of the St. Paul Union Stockyards Co., South St. Paul, Minn.

A petition was filed by licensees furnishing coops and trucking live poultry in the designated areas of New York and Jersey City seeking a modification of the rates and charges prescribed by the Secretary for these services. A hearing was under way at the close of the year.

Audits and tabulations of the books and records of licensed poultry receivers in New York were completed, and arrangements were being made to hold a hearing respecting their rates, charges, and practices.

BONDS

Market agencies and dealers in general have complied with the bond regulation. In those cases, however, in which bonds were not furnished and could not be obtained through informal action, formal proceedings were instituted to compel compliance with the bond regulation. A change was made in the regulation respecting the amount of bond required of agencies engaged in business on markets at which sales of livestock are held during not more than 2 days in any week of each year. The purpose of the change was to insure more adequate protection to livestock shippers and producers patronizing such markets, and also to remove certain apparent inequalities between those markets and others on which sales of livestock are made on a larger number of market days. This change had the effect of increasing the amount of bond required in certain cases.

TRADE PRACTICES

Supervisors continued, as usual, to make investigations and reports on general marketing practices and conditions, with respect to both livestock and live poultry. They assisted in handling matters relating to the filing of tariffs and regulations of market agencies, stockyard companies, and licensees. Many complaints involving alleged violations of the various provisions of the Packers and Stockyards Act were received and carefully investigated by supervisors and special investigators in the field.

A considerable number of trade-practice audits of the records of market agencies, dealers, and licensees were made at various stockyards and designated cities. Some of these revealed conditions that required the institution of formal proceedings.

Following the completion of an extensive hearing involving alleged violations of title II of the act by one of the large packing companies, an examiner's report was issued and oral arguments held before the Secretary. As a result of this procedure, an order was issued by the Secretary requiring the packer to cease and desist from certain violations. This case was of more than ordinary interest and importance inasmuch as such fundamental matters were involved as the extension of credit to purchasers, discounts given to various classes of purchasers and not to others, and discriminatory practices in regard to the sale, by weight, of various packing-house products. The order of the Secretary found that the packer was engaging in unfair and unjustly discriminatory practices in connection with these trade matters, and the packer was ordered to cease and desist therefrom. The packer was arranging at the close of the year to obtain a review of this order by a Federal circuit court of appeals.

Toward the close of the year a hearing was commenced against four large packing companies and some of their subsidiaries involving alleged violations of various provisions of title II of the act. These violations included alleged combinations and agreements to manipulate and control prices at which livestock and other articles are purchased and packing-house products are sold and the apportionment of territories in which purchases and sales are made.

SCALES AND WEIGHING

Bureau weight supervisors made visits to practically all posted stockyards. All scales were inspected, and tests were supervised by these employees. They also supervised tests of scales in designated poultry areas. Any scales found to be defective and not weighing within the tolerances permitted by the Bureau were required to be repaired, corrected, and put in satisfactory condition.

AUDITS AND ACCOUNTS

Accountants of the Bureau completed a 5-year audit of the books and records of the stockyard company at Fort Worth, Tex., in connection with an investigation into its rates and charges, which audit had been begun in the previous fiscal year. There were also completed similar 5-year audits of the books and records of the Union Stock Yards Co., Dayton, Ohio, and the Bourbon Stock Yards Co., Louisville, Ky., relative to the reasonableness of their rates and charges. Early in the year a preliminary audit of the books and records of the St. Paul Union Stockyards Co., of South St. Paul, Minn., was made in which particular attention was given to yardage and feed charges. As a result of this, a 5-year rate audit was begun at this yard but had not been completed at the close of the year. Accountants made audits at St. Joseph, Mo., Omaha, Nebr., Sioux City, Iowa, and Peoria, Ill., in connection with petitions for modification of stockyard rate orders. Audits were also made of the records of market agencies at Denver, Colo., Sioux City, Iowa, Kansas City, Mo., and National Stock Yards and Chicago, Ill., in connection with petitions for modification of commission rates previously prescribed by the Secretary. Routine stockyard audits were made of the books and records of 7 stockyard companies, financial and insolvency audits of 51 market agencies, and trade-practice audits of 8 market agencies located at various markets.

Under the poultry amendment, audits were made of the coop and truck service companies at New York City in preparation for a rehearing directed by the Secretary based on a petition seeking modification of rates he had previously prescribed. Preparatory to a hearing as to the reasonableness and lawfulness of the rates, charges, and practices of 33 receivers of live poultry in New York, audits were made of the books and records covering their 1936 and 1937 operations. Audits also were made of the books and records of 448 dealers in live poultry located at New York City, Chicago, and St. Louis. The purpose of these audits in most cases was to determine whether the financial condition of the applicants justified the issuance of licenses.

SUMMARIES OF REPORTS

Information compiled from the annual reports received from packers, stockyard companies, market agencies, and dealers is shown in tables 13 to 18, inclusive. The various reports cover business during the calendar year, with a few exceptions, which are on the basis of the fiscal year.

TABLE 13.—*Financial results of operations during 1937 for 808 packers subject to the Packers and Stockyards Act, grouped according to federally and nonfederally inspected slaughtering and nonslaughtering concerns*

Group	Concerns	Average net worth [1]	Net sales	Net gain
	Number	*Dollars*	*Dollars*	*Dollars*
Federally inspected slaughterers	188	658, 820, 264	2, 979, 390, 553	19, 096, 345
Nonfederally inspected slaughterers	397	53, 668, 482	318, 112, 793	2, 679, 686
Nonslaughterers [2]	223	158, 964, 578	362, 768, 153	11, 097, 966
Total	808	871, 453, 324	3, 660, 271, 499	32, 873, 997

[1] These figures represent the numerical average of the total net worth of reporting concerns at the beginning and end of their fiscal years.
[2] This group includes concerns which also handle commodities other than meat food products.

In addition to the complete reports from 808 packing concerns, financial details, lacking in some respects, were received from 10 other packers for the year 1937.

TABLE 14.—*Comparison of the operations of packers subject to the Packers and Stockyards Act, 1933–37*

Item	1933 (871 concerns)	1934 (851 concerns)	1935 (845 concerns)	1936 (815 concerns)	1937 (808 concerns)
Average net worth [1]	$921, 602, 012	$882, 571, 885	$852, 538, 940	$889, 482, 318	$871, 453, 324
Total income	2, 096, 484, 225	2, 556, 583, 329	3, 103, 710, 410	3, 428, 937, 625	3, 674, 283, 968
Total expenses	2, 062, 288, 906	2, 517, 304, 623	3, 054, 326, 490	3, 377, 004, 485	3, 641, 409, 971
Net gain	34, 195, 319	39, 278, 706	49, 383, 920	51, 933, 140	32, 873, 997
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
Percentage of gain to net worth	3. 71	4. 45	5. 79	5. 84	3. 77

[1] These figures represent the average of the total net worth of all reporting concerns at the beginning and end of their fiscal years.

TABLE 15.—*Summary of consolidated balance sheets of 127 posted stockyards at close of year 1937* [1]

Assets	Amount	Liabilities	Amount
Current	$8, 412, 806	Current	$4, 054, 225
Fixed	142, 316, 564	Other	42, 945, 196
Other	9, 751, 385	Capital and surplus	113, 481, 334
Total	160, 480, 755	Total	160, 480, 755

[1] Reports from 2 yards were waived, 37 yards were posted too late for tabulation, and report from 1 yard was not received.

A summary of consolidated profit and loss statements of 127 posted stockyards for the year 1937 [1] follows:

Income:	
Yardage	$10, 843, 264
Feed sales	8, 078, 223
Loading and unloading	1, 354, 892
Rent	1, 953, 928
Miscellaneous operations	13, 869, 508
Gross operating income	36, 099, 815

[1] Reports from 2 yards were waived, 37 yards were posted too late for tabulation, and report from 1 yard was not received.

Expenses:	
Salaries and wages	$7,104,281
Cost of sales—feed	4,587,571
Depreciation	1,812,279
Taxes (excluding Federal income tax)	1,729,765
Miscellaneous operating expenses	15,275,502
Total operating expenses	30,509,398
Net operating profit	5,590,417
Other income	535,893
Total	6,126,310
Deductions from income	1,605,827
Net profit	4,520,483

TABLE 16.—*Summary of reports from stockyard companies subject to the Packers and Stockyards Act, 1933–37*

Item	1933 (82 concerns)	1934 (92 concerns)	1935 (96 concerns)	1936 (104 concerns)	1937 [1] (127 concerns)
Total average net worth	$118,196,617	$117,327,650	$113,068,502	$113,985,320	$113,580,915
Gross income	24,649,150	31,728,793	31,264,036	31,042,706	36,635,708
Net gain	5,471,264	6,860,729	4,149,287	5,023,744	4,520,483
Percentage of gain to net worth	*Percent* 4.63	*Percent* 5.85	*Percent* 3.57	*Percent* 4.41	*Percent* 3.98

[1] Reports from 2 yards were waived, 37 yards were posted too late for tabulation, and report from 1 yard was not received.

LIVESTOCK COMMISSION AGENCIES

Number and class of market agencies reporting in 1937 follow:

Old-line agencies	696
Cooperative agencies	52
Horse and mule agencies	12
Total	760

TABLE 17.—*Summary of consolidated operating statements of livestock commission agencies, 1935–37*

Item	1935 (740 agencies)	1936 (740 agencies)	1937 (760 agencies)
Total commissions earned	[1] $17,164,661	[2] $18,787,713	$18,340,239
Total expenses (exclusive of owners' salaries)	12,922,615	13,864,886	14,139,390
Net operating profit	4,242,046	4,922,827	4,200,849
Other income	970,686	667,041	984,959
Other expenses	42,478	33,635	55,022
Return to owners	[1] 5,170,254	[2] 5,556,233	5,130,786

[1] Does not include $197,033.41 impounded commissions reported.
[2] Does not include $84,434.08 impounded commissions reported.

TABLE 18.—*Summary of consolidated profit and loss statements of 884 traders on 60 markets for 1937* [1]

Item	Dockage [2]	Animals handled	Weight	Amount
Cattle (659 traders on 52 markets):	*Pounds*	*Number*	*Pounds*	*Dollars*
Selling data		4,392,519	2,554,494,345	172,860,777
Cost data		4,393,273	2,540,882,784	166,692,271
Sheep (88 traders on 39 markets):				
Selling data		1,398,505	110,167,142	9,388,817
Cost data		1,400,325	108,120,872	9,053,936
Horses and mules (14 traders on 8 markets):				
Selling data		27,200		3,488,186
Cost data		27,200		3,121,925
Hogs (220 traders on 48 markets):				
Selling data	1,971,951	4,818,935	1,129,617,485	102,909,860
Cost data	2,185,336	4,819,254	1,123,485,900	101,251,865
All species (884 traders on 60 markets):				
Selling price				288,647,640
Cost price				280,119,997
Gross trading profit				8,527,643
Clearance commissions received				106,448
Other income				204,051
Total earnings				8,838,142
Expenses:				
Salaries and wages (other than owners')				1,292,189
Clearance commissions paid				666,311
Feed				1,825,495
Yardage				226,855
Other expenses				1,642,169
Total expenses				5,653,019
Return to owners				3,185,123

[1] Does not include traders who were engaged also in order-buying business. Some of the traders handled more than 1 species.

[2] Represents deduction in weight at time of sale because of quality or condition of the animal. This practice applies only to hogs.

CONTROL OF INTERSTATE TRANSPORTATION OF LIVESTOCK

In the supervision of the interstate transportation of livestock to prevent the spread of animal diseases, Bureau inspectors at 48 stockyards in 46 cities inspected 19,969,118 cattle and 23,981,953 sheep. Of these animals, 8,400 cattle and 594,782 sheep were dipped under supervision to comply with the regulations of the Department and the various States to which they were destined. Swine inspected numbered 21,092,162, of which 205,332 were immunized and disinfected against hog cholera under Bureau supervision for distribution for feeding and breeding purposes.

Efforts were continued to minimize losses among stocker and feeder cattle and sheep on account of infectious disease. Divisions of public stockyards in which such livestock were handled were cleaned and disinfected under Bureau supervision.

There were received at the Bureau stations 1,515 cars carrying animals affected with communicable diseases. Under Department regulations or on request of Canadian Government, State, and railroad officials, 5,449 cars were cleaned and disinfected under the supervision of Bureau employees.

Experienced veterinary inspectors at public stockyards continued to give particular attention to the inspection of all ruminants and swine for foot-and-mouth disease, no case of which was found.

ENFORCEMENT OF TRANSPORTATION AND QUARANTINE LAWS

In the administration of the 28-hour law many improvements were made in the facilities for feeding, watering, and resting livestock while in transit; 289 alleged violations of the 28-hour law were reported to the Bureau. The Bureau transmitted 221 apparent violations to the Solicitor for presentation to the Attorney General. Penalties amounting to $29,200 were imposed in cases decided in favor of the Government. Five employees devoted most of their time to this work, but the evidence was collected and the reports prepared largely by employees stationed at public stockyards whose time was devoted chiefly to other lines of work.

Twenty-eight alleged violations of the quarantine laws were reported to the Bureau, all of which were transmitted to the Solicitor for prosecution. In cases decided in favor of the Government, fines imposed amounted to $2,100.

PATHOLOGICAL DIVISION

Under the direction of Harry W. Schoening, Chief, the Pathological Division followed the usual lines of scientific investigation of the diseases of domestic animals and birds, the poisoning of livestock by plants, and the examination of viruses, serums, and other biological products used in the treatment and prevention of diseases of domestic animals.

DIAGNOSIS AND CONTROL OF DISEASES

Cooperative work in the control and eradication of glanders in the various States was continued. The complement-fixation test was applied to 187 samples of blood serum from animals suspected of being affected with or exposed to the disease. Only five positive reactions were obtained.

Samples of blood serum from 550 horses in districts where dourine has been present or suspected were subjected to the complement-fixation test, and 1 gave a positive reaction. Blood serums from 34 horses, donkeys, and other animals offered for import were tested by complement fixation for glanders and trypanosomiasis before being admitted. No positive reactions were obtained.

Forty-nine brain specimens from suspected cases of rabies were received and subjected to laboratory examinations. Of these, 37 were from dogs, 10 from cats, 1 from a hog, and 1 from a squirrel. One dog from the District of Columbia, one from Maryland, and one from West Virginia were found to be positive for rabies, the remaining specimens being negative. The positive case from the District of Columbia was that of a dog which had been brought into the District from South Carolina 3 weeks before it developed the disease.

TESTING BIOLOGICAL PRODUCTS

Cooperating with the Division of Virus-Serum Control, the Pathological Division tested 97 samples of serums, antitoxins, vaccines, bacterins, aggressins, filtrates, and toxoids for purity, potency, and safety. Of these, 49 were approved and 48 were found to be unsatisfactory. Of 80 cultures examined, 46 were approved and 34 were unsuitable for the preparation of veterinary biologics.

INFECTIOUS EQUINE ENCEPHALOMYELITIS AND RELATED DISEASES

During the summer and fall of 1937, infectious equine encephalomyelitis caused the most serious losses ever recorded in this country. According to a survey by questionnaire, more than 169,000 actual cases and approximately 40,000 deaths due to this disease occurred. More than 90 percent of the cases were in the watersheds of the Mississippi River and its tributaries. Some of these States in this area had been affected in the last few years prior to 1937. Laboratory diagnoses have now established the existence of the specific disease in 22 States, by the addition of Georgia and South Carolina during the 1937 season. Although virus was not recovered, definite histological evidence of the disease was obtained from examination of Oklahoma and Florida cases also.

It is estimated that 100,000 horses received formolized brain-tissue vaccine prior to or during the epizootic, the available evidence clearly favoring its use before an outbreak begins.

A field survey, emphasizing especially the investigation of the role of blood-sucking insects in the spread of the disease, was conducted with the cooperation of the Bureau of Entomology and Plant Quarantine, and the Oklahoma Agricultural and Mechanical College. In the course of the study, numerous specimens of mosquitoes were collected from affected and normal animals, as well as man, and from the vegetation and terrain of premises on and near which the disease occurred. The insects were used for feeding on or injection into laboratory animals, chiefly guinea pigs, as well as for identification purposes. In addition, large numbers of stableflies and a few horseflies, barnflies, houseflies, and one small group of ear ticks were similarly utilized. In all, approximately 10,000 insects in 90 lots were collected. Approximately 500 guinea pigs were used in the studies. Two ponies, a mare and suckling colt, were subjected to the bites of approximately 4,000 stableflies, collected under the conditions outlined without developing symptoms of encephalomyelitis. With a few exceptions involving inconclusive evidence, none of the inoculated guinea pigs developed symptoms of the disease.

As usual, the disease receded rapidly with the appearance of killing frosts and insect studies were necessarily terminated. Despite the failure to demonstrate virus in bloodsucking insects in nature, the known facts concerning the disease strongly support the prevailing opinion, based also on experimental evidence, that the disease is so transmitted naturally. The available evidence continues to appear to favor mosquitoes rather than ticks, gnats, or bloodsucking flies as vectors of the disease.

The year's work indicated also, in connection with laboratory studies, that the possibility of propagating infectious anemia virus as a contaminant, when working with encephalomyelitis in guinea pigs, is unlikely.

From answers to questionnaires, it was determined that the so-called secondary or X disease that follows epizootics of encephalomyelitis was not prevalent. Epizootiological evidence suggests that antiencephalomyelitis or other serums may be implicated in the etiology of the disease. This possibility is being investigated.

Opportunity to study a few cases of sporadic hemorrhagic encephalitis was afforded. One was concluded to have been due to barium poisoning. Others were also apparently of a toxic nature, although the exact cause was not proved.

PERIODIC OPHTHALMIA

Investigation of periodic ophthalmia was undertaken to obtain information on the incidence of the disease and to determine, if possible, factors that, from a field standpoint, might be correlated with the disease.

Field study was made in an area where practicing veterinarians reported that the disease was prevalent and appeared to be on the increase. Inspections were made of 312 farms on which there were 2,051 horses and mules. On 144 of these farms, the disease was found in one or more animals. On the remaining 168 farms, no periodic ophthalmia was present at the time of inspection, and on 111 of them the disease was reported never to have occurred. The data from the farms where the disease occurred, when compared with corresponding data from farms where it did not, failed to furnish any clue as to any factor or combination of factors that could be considered either a cause of the disease or predisposing factor. This study is being continued.

INFECTIOUS ANEMIA (SWAMP FEVER)

To obtain further information on the distribution of infectious anemia, investigations were made on six farms in Maryland and Virginia of a disease in horses reported by the attending veterinarians to resemble infectious anemia. In three instances the clinical symptoms were suggestive of this disease, and horse inoculation tests proved the disease to be infectious anemia. A study was made also of blood specimens forwarded by a Louisiana veterinarian who suspected that a peracute, rapidly fatal disease that occurs more or less each year in mules on certain sugarcane plantations in southern Louisiana, is a virulent form of infectious anemia. According to the reports, the onset of the disease is sudden, the fever is high, and the animals are soon prostrated. Death occurs within a week to 10 days. The disease attacks a number of mules at the same time and the termination is usually fatal. No pathogenic micro-organisms or blood parasites were found in the specimens. Filtered blood serum produced, in normal horses, a disease that was clinically typical of infectious anemia. The same filtrate inoculated into horses affected with infectious anemia in the inactive form caused no reaction, indicating that the disease in question is infectious anemia. The uniformly peracute and rapidly fatal course that the disease takes and the affection of a number of animals in a herd at the same time are unusual for infectious anemia.

Further studies of the virus of infectious anemia showed that the virus in blood serum and in brain tissue was fully active when tested after 90 days in refrigeration at 5° C. The virus in frozen-spleen tissue was active after 13½ months' storage at temperatures between −7° and −12°. The virus in spleen and lymph-gland tissue ground

and dried over calcium chloride in a vacuum desiccator at 5° was fully virulent when tested after 9 months.

Fractionation of serum by the ammonium sulphate method as commonly used by commercial biological manufacturers in concentration of antitoxins destroys the virus of infectious anemia. Horse inoculation tests showed no active virus in either the euglobulin, pseudoglobulin, or serum albumin fractions or in the final filtrate of such serum.

By horse inoculation test it was shown that a horse that had made a clinical recovery from the disease harbored virulent virus in the blood stream 34 months after experimentally induced infection.

In an investigation to determine the possibilities of transmission of this disease by parasites, 45 bloodsucking lice (*Haematopinus asini*) were taken from a horse during an acute febrile reaction and transferred to a normal horse. The disease was not transmitted. In previously reported tests it was shown that *Strongylus* spp. collected from horses affected with infectious anemia contained the virus within their bodies. However, tests showed that the larvae of these parasites that passed out with the feces did not contain the virus. An extract of more than 2 million larvae, collected from horses affected with infectious anemia, injected into a normal horse did not reproduce the disease. Nor did feeding of more than 700,000 strongyle and cylicostome larvae from an infected horse to a normal horse reproduce the disease. Filtered extracts of bots taken from a horse with infectious anemia did not reproduce the disease in a normal horse by subcutaneous inoculation.

An effort was made to prepare a spleen-tissue vaccine in a manner similar to that used in preparing rinderpest vaccine: that is, attenuation by drying over calcium chloride in a vacuum desiccator at 5° C. for 2 to 3 weeks. Unlike the virus of rinderpest, the virus of infectious anemia was not attenuated by this process but remained fully virulent after drying for 9 months. Its use as a vaccine, therefore, was obviated.

Sulphanilamide was found to be without value as a therapeutic agent for curing animals affected with infectious anemia. Administration of sulphanilamide three times daily for 4 days in quantities that maintained a concentration in the blood of 20 milligrams per 100 grams, or a higher concentration, did not prevent a recurrence of febrile reactions in one infected horse.

Further efforts were made to utilize the complement-fixation test for diagnosis of infectious anemia. Spleen tissue known to contain antigenic properties was frozen and dried in vacuum. This material was used from time to time as an antigen, and no change in its titer has been noted over a period of 13 months.

Twenty-seven spleens taken from horses dead of infectious anemia were tested for antigenic value, and 14 reacted positively. The remaining 13 were negative.

SWINE ERYSIPELAS

In connection with the study of the agglutination reaction in swine erysipelas, further attention was given to the antigen in respect to stability. As now prepared, the antigen was found to have good keeping qualities. Samples of both stained and unstained antigen

stored at room temperature in sealed containers were found to be satisfactory when tested 1 year later.

By use of a supercentrifuge having a speed of 30,000 revolutions per minute, four times as much finished antigen can be obtained from a given quantity of bouillon culture as formerly was possible with a cup centrifuge having a speed of 3,000 revolutions per minute.

In an investigation of a disease condition in swine in which 90 percent or more of the animals had enlargements about the joints, it was found that the swellings represented infections of the synovial sacs and tendon sheaths. There was an absence of exostoses and no evidence of the erosion of the articular surfaces sometimes seen in swine erysipelas. On bacteriological examination a variety of organisms, principally streptococci, staphylococci, corynebacteria, and *Alcaligenes bronchisepticus*, were cultured from these enlargements, but no swine erysipelas organisms were found.

For the purpose of studying the mode of transmission and methods of control of swine erysipelas, more than 100 hogs have been raised to maturity from a swine-erysipelas-infected herd of 30 sows and boars established last year. These animals were separated from their dams after weaning and placed on clean ground. In none of these animals, now full-grown hogs, has any clinical evidence of swine erysipelas been found.

Preliminary tests were made with three kinds of live-organism vaccines to study the effect of these types of vaccines on the animals. Nine pigs were vaccinated with a product composed of live swine-erysipelas organisms of the rough type, which previous study had shown were avirulent for susceptible laboratory animals. Nine pigs were treated simultaneously with (1) a vaccine composed of swine-erysipelas organisms of the smooth type virulent for susceptible laboratory animals and (2) swine-erysipelas serum. Nine pigs were vaccinated with a commercially prepared live-organism vaccine, such as is used in European countries, and received simultaneously an injection of swine-erysipelas serum. Each of these groups was maintained in a separate lot with an equal number of unvaccinated pigs. Observation of these animals over a 10-month period following vaccination failed to show clinical evidence of infection with swine erysipelas in any of the vaccinated groups or any of the unvaccinated animals in contact with them continuously. Repeated efforts to develop an experimental exposure to swine erysipelas that would be suitable for testing the relative immunities of these three vaccinated groups have been without success. This work is being continued.

A highly potent swine-erysipelas antiserum was prepared in horses. This serum in doses of 0.01 cc protected mice against a fatal dose of swine-erysipelas organisms.

To establish a standard of potency for commercially prepared swine-erysipelas antiserum, tests of a number of samples of such serums were made, both the mouse-protection test developed by Marx and the pigeon-protection test reported by Leclainche being used. The results of these studies indicate that the mouse-protection test is good provided uniformly susceptible mice are available and are not harboring any pathogenic micro-organisms. The pigeon-protection test is also satisfactory and has a decided advantage in that the test animals are not highly susceptible to extraneous infections and for this reason are better suited for routine testing than mice.

ANAPLASMOSIS

In studies of anaplasmosis, three cows were each given an average of 250 cc of 0.5-percent crystal-violet solution intravenously on 4 different days. Composite samples of their blood had previously produced an acute fatal case of anaplasmosis in a splenectomized calf. These cows showed severe toxic symptoms after each injection. A composite sample of blood from these animals collected 28 days after the last injection produced an acute case of anaplasmosis in a splenectomized calf. Several months later the spleens were removed from the cows and all three developed acute cases of anaplasmosis, two of which were fatal. It is concluded from this experiment that the injections of crystal-violet solution did not destroy the anaplasmata in any of the three cows.

Cattle in the febrile stage of anaplasmosis frequently are constipated, usually have an impacted rumen, and often void large volumes of urine while refusing to drink water. Moreover, there are marked indications of dehydration at autopsy. It has been observed that animals which continue to drink water throughout the course of the disease usually recover, whereas animals that refuse to drink or drink only very small quantities of water usually die. It was believed, therefore, that hydrotherapy would prove beneficial. Of five experimental animals with anaplasmosis, only three entirely stopped drinking water and these three were selected for treatment. The other two animals recovered without treatment. The water was given through a stomach tube daily in quantities sufficient to distend to a comfortable fullness the flanks of the animals. Two of the treated animals recovered and one died. In the animal that died, dehydration usually found at autopsy was absent. Better results probably would be obtained if treatment were begun as soon as the animals drank less water than usual instead of waiting until they entirely stopped drinking.

Red-water symptoms were observed in two fatal cases of experimentally induced anaplasmosis in splenectomized cows. In both animals bloody urine was voided for several days before death, and their bladders were filled with bloody urine at autopsy. Smears were made of the urine of the cows, but no entire red blood cells were observed. The benzidine test for hemoglobin was positive.

MISCELLANEOUS DISEASES

Extensive tests were made of samples of four lots of anthrax pellets that were alleged to have produced anthrax in cattle when used for immunization purposes during the extensive outbreak of anthrax in South Dakota during the summer of 1937. These pellets were subjected to all possible cultural and laboratory-animal inoculation tests, as well as cattle-inoculation tests. The cultural and laboratory-animal inoculation tests showed that the pellets were composed of anthrax spores, of vaccine strains only, and were of proper strength for a single-injection spore vaccine. None of the 11 cattle injected with the pellets showed any ill effects of the vaccination. Examination of blood specimens from animals that allegedly had died of vaccination anthrax showed anthrax organisms of the virulent field-anthrax type only. The results indicate that the pellet vaccines were not faulty and that the losses in cattle following vaccination were due

to virulent field anthrax. The losses that occurred shortly after vaccination may well be attributed to the increased susceptibility of the animals during the negative phase of active immunization.

Through questionnaires submitted to cattle buyers, the investigation begun in 1934 to determine the value of sodium bicarbonate for the control of shipping fever in cattle was continued. On the basis of the reports submitted for more than 59,000 cattle, the incidence of shipping fever was not reduced by treatment with sodium bicarbonate since 4.84 percent of the treated animals sickened as compared with 1.28 percent of untreated animals. Deaths in the treated groups were 0.24 percent as compared with 0.06 percent in the untreated groups.

Potency tests of rabies vaccines in rabbits were continued, using the intralingual method for exposure of vaccinated animals to the virus. In one experiment, 12 rabbits were inoculated intralingually with fixed virus. Twenty-four hours later half of these rabbits were injected intraperitoneally with 5 cubic centimeters of chloroform-killed canine rabies vaccine. The same injection was given on the 2 succeeding days to this group of rabbits. The remaining six rabbits were left untreated as controls. None of the six vaccinated rabbits developed rabies, whereas five of the six control animals died of this disease. In a second experiment, 18 rabbits were injected intralingually with fixed virus. Twenty-four hours later six rabbits were given a 5-cubic-centimeter intraperitoneal injection of chloroform-killed rabies vaccine, and a similar injection was given on the 2 succeeding days. Six rabbits were treated with the same vaccine and at the same time except that the vaccine was administered subcutaneously. The third group of six rabbits served as controls. Two of the six rabbits treated intraperitoneally survived, whereas all the rabbits treated subcutaneously, as well as all the controls, died of rabies. In this experiment, the rapidity with which the rabbits developed rabies indicated a very heavy exposure to virus and this may account for so few rabbits surviving in this experiment as compared with the previous one. There is need for a more definite standardization of exposure virus, work on which is being undertaken.

Specimen tissues from 17 sheep suspected of having tuberculosis were received, for examination, from establishments operating under Federal meat inspection. From 14 of the specimens tubercle bacilli of the avian type were recovered. In two of the remaining three specimens, histological examination revealed lesions typical of those of tuberculosis. Study of the other specimen disclosed the presence of parasites.

In a group of calves kept entirely separate from the adult cattle in a dairy herd, 14 individuals reacted to the tuberculin test. No reactors were found among the adult animals. The disease was found to be due to the avian type of tubercle bacillus.

An unusually virulent type of warts was encountered in a dairy herd. The affected animals were calves, from 6 to 10 months of age, which had numerous large and small papillomatous growths on various parts of the head, neck, dewlap, shoulders, and legs, and also scattering growths on various other parts of the body. Two of these warty animals were used for experimental purposes. One received autogenous treatment, consisting of subcutaneous injections of 50

cubic centimeters of a filtered saline extract of warts removed from the same animal. Three injections of the wart filtrate were given at approximate intervals of 2 weeks. No immediate results were apparent following the autogenous treatment and the warty growths on this heifer showed no definite change for 3 or 4 months. During this time there had been a gradual recession in the size of many of the warts. During the following 6 months there was a marked change in the warty growths, the larger ones rapidly drying up and a large percentage of the smaller ones disappearing. Owing to the long time elapsing between the treatments and the definite improvement in the warty condition of this heifer, no definite conclusion was reached as to the possible effects of the autogenous treatment. The other heifer was treated with bismuth subsalicylate, which has apparently been used with good results in the treatment of warts on man. This treatment consisted in repeated intramuscular injections of oil suspensions of the bismuth subsalicylate. The animal received six injections of 20 cubic centimeters each of this material, in the gluteal region at weekly intervals. No definite change could be seen in the warty growths following the six injections.

Studies of actinobacillosis and actinomycosis were continued. In a well-developed, advanced case of actinobacillosis in a steer, with extensive lesions in the cervical glands, the causative organism was not demonstrable in the blood stream, though large quantities of blood taken at time of slaughter were used. Actinobacillosis, affecting lymph nodes essentially, appears to be disseminated in the body by means other than the blood stream. The recovery of an anaerobic *Actinomyces*, resembling *A. bovis*, from the salivary gland, the sole lesion encountered in the animal, is an example that all cases of granulation and suppuration with the formation of rayed clubs in the soft tissues are not actinobacillosis. In classical actinomycosis involving the bone primarily, anaerobic actinomyces in pure culture were seldom found. Even in closed lesions, other organisms as *Staphylococci* and *C. pyogenes* were usually present. Apparent differences in the rosettes of actinomycosis and actinobacillosis were observed. The rosettes in actinomycosis are usually larger and comparatively few in number.

Tests were made of commercial poultry vaccines for fowl pox and laryngotracheitis. Among these were embryo-propagated vaccines for both diseases. This method of preparing these products was found to be satisfactory.

Of 206 commercially prepared whole-blood, stained, pullorum-disease antigens examined in connection with the National Poultry Improvement Plan, 5 specimens were disapproved and the remaining 201 found to be satisfactory.

Specimens from 97 cattle were examined for paratuberculosis. Of these, 86 positive cases were found microscopically. The production of intradermic and intravenous johnin for use in testing cattle in suspicious herds and cattle for export was continued, 4,800 cubic centimeters of the product being prepared. From reports received on the results obtained from use of johnin in the field, this year's product appears to be more reliable and potent as a diagnostic agent than that of previous years.

In experiments directed at the development of better methods of diagnosing paratuberculosis by the use of small laboratory animals,

promising results were obtained with guinea pigs and rabbits. These animals, which are refractory to inoculation with saline suspensions of *Mycobacterium paratuberculosis*, were infected when injected with cultures of the organisms combined with paraffin oil. Animals so inoculated succumbed in from 30 to 90 days. The lesions found at autopsy consisted of small (0.1 to 0.4 centimeter) grayish-white foci scattered over the serous membranes of the peritoneal and thoracic cavities. While the lesions at times extended beneath the capsule of the liver and other organs, there appeared to be no tendency toward involvement of the deeper portions of the organs. In some instances the lesions remained localized at the seat of inoculation. Microscopic examination of material from the lesions revealed numerous *M. paratuberculosis* organisms. Up to the present, inoculations of chickens with the organisms in paraffin oil have not given rise to definite signs of infection.

Material from intestinal lesions in cattle was treated with 40-percent antiformin for one-half hour, then suspended in paraffin oil and inoculated into rabbits and guinea pigs. Infection occurred in all cases, with the production of lesions similar to those induced by inoculation with cultures combined with the oil. Death occurred in approximately 60 days.

It was found that guinea pigs inoculated with a saline suspension of ground organs of guinea pigs that had succumbed to paratuberculosis infection also died of the disease and revealed typical lesions at autopsy. Attempts to immunize laboratory animals by injection with heat-killed cultures of *Mycobacterium paratuberculosis* suspended in sterile normal horse serum and equal parts of 0.5-percent sodium carbonate solution were unsuccessful.

INVESTIGATIONS OF STOCK-POISONING PLANTS

The study of bighead in sheep was continued. As a result of feeding experiments with littleleaf horsebrush (*Tetradymia glabrata*) and spineless horsebrush (*T. canescens* var. *inermis*), additional information was obtained on the effect of the previous diet as a predisposing factor in producing photosensitivity, which is responsible for the swelling of the head. These two species of horsebrush are considered to be the principal cause of range bighead and will produce death when only relatively small quantities are consumed. However, they are unpalatable and are usually eaten in dangerous quantities only when the animals are unable to obtain more desirable forage plants. Any system of prevention must be based on this fact and an adequate supply of desirable forage should be provided for the sheep while they are in the dangerous areas.

TOXICOLOGICAL INVESTIGATIONS

Studies of the conditions under which certain plants produce hydrocyanic acid and animals become poisoned by them were continued in cooperation with the Bureau of Plant Industry. Analysis of samples from seven States showed that in the case of sorghum there is a gradual decrease in the hydrocyanic acid content as the plant grows and that late in the season, after the grain has formed, the plant ceases to be dangerous. In exceptional cases, however, it appears that

some peculiar factor or factors produce unexpected increases in the hydrocyanic acid content and render the plants suddenly and temporarily dangerous. The character of these factors is still under investigation. It was found also that considerable differences exist among varieties of sorghums in their capacities to produce hydrocyanic acid and that, on the whole, these differences persist from year to year.

Much attention was given to the action of small concentrations of acid on the evolution of hydrocyanic acid from plants. It was found that concentrations of acids likely to be met with in physiological liquids such as gastric juice have little effect on the production of hydrocyanic acid. The comparative immunity of guinea pigs, rabbits, horses, and swine to poisoning by cyanogenetic plants does not appear to be correlated with the gastric acidity of these animals.

A study was made of the influence of soils on the content of hydrocyanic acid in sorghum grown on different soils. Wide differences were found.

The study of the hydrocyanic acid content of first- and second-growth sorghum of comparable size was continued. The results are somewhat variable but indicate that the age of the plant is the determining factor in hydrocyanic acid content.

Work on the remedy for cyanide poisoning in animals was continued as was the study of the hydrocyanic acid level at which cyanogenetic plants become dangerous for animals. A number of feedings to sheep were made of sorghums of known hydrocyanic acid content. The results are as yet incomplete but indicate that a level of 60 milligrams per 100 grams of dry plant is usually fatal. In green plant the quantity is about 20 to 30 milligrams per 100 grams.

An extensive study of the iodine test for the presence of dangerous quantities of hydrocyanic acid in sorghums was made. The test was found unreliable.

Investigation of the toxicity of moldy oat hay was continued. Feedings of oat hay infected with one of the molds involved were made to guinea pigs with negative results.

A study of the alkaloids of the coral bean of Texas (*Sophora secondiflora*) has shown thus far that earlier accounts which ascribed the greater part of the alkaloid content to cytisine are in error and that other alkaloids are present to a considerable extent.

BRANCH LABORATORIES

CHICAGO

The branch pathological laboratory at Chicago, Ill., was engaged, as in previous years, in investigating diseases of meat food animals and aiding the Federal meat-inspection service by rendering diagnoses of obscure or unusual diseases and conditions. A special study of cancer eye, or epithelioma of the eye, of cattle revealed the frequent involvement of the bony tissue of the skull in the region of the eye with metastatic tumor formations accompanied by necrosis and disappearance of large areas of bone tissue. Such malignant tumors were found usually to extend through the necrotic areas of the bones and to invade the interior of the skull, filling the sinuses and replacing the normal tissues.

A condition, commonly referred to as leukemia or pseudoleukemia and characterized by enlargement of lymph glands and grayish-

white deposits in various tissues and organs, is frequently encountered in all species of food-producing animals. Pathological studies revealed that the lesions found in this condition are malignant and metastatic new growths of a sarcomatous character. The essential tumor cells were either young, immature, malignant, neoplastic reticulum cells or tumor cells closely related to or derived from embryonic reticulum cells. The blood is usually not involved but in some cases it may be, and this involvement is regarded as a secondary condition or metastases to the blood stream.

DENVER

During the year 6,350 specimens were examined at the Denver, Colo., laboratory. Of 3,143 cattle tested for Bang's disease, 88.2 percent were negative, 8.2 percent positive, and 3.4 percent suspicious, according to agglutination tests made in the laboratory.

In further studies on coccidioidal granuloma, the disease was found in cattle 8 months to 10 years of age. Lesions in the lungs, in addition to involvement of the thoracic lymph nodes, occurred in cattle of all ages. A lesion in the prepectoral lymph node was found in one case. Data from the Los Angeles and Denver meat-inspection stations reveal that in 25 lots of cattle totaling 910 animals, there were 131 retentions for coccidioidal granuloma, or approximately 14 percent infection.

In the various specimens examined, 52 neoplasms were distributed as follows: 27 in cattle, 9 in dogs, 6 in swine, 4 in sheep, 4 in chickens, and 2 in foxes.

DIVISION OF TICK ERADICATION AND SPECIAL DISEASES

The Division of Tick Eradication and Special Diseases, under the direction of W. M. MacKellar, Chief, conducted the Bureau's cooperative work in the eradication of the cattle-fever tick and in hog-cholera control.

TICK ERADICATION

The eradication of the cattle-fever tick was conducted in cooperation with State, county, and Territorial officials and cattle owners of the South and in Puerto Rico.

At the close of the fiscal year, 414 veterinarians and other Bureau employees were working in cooperation with 364 State and 27 county employees engaged in this project. In addition to these regular employees, other workers furnished under the provisions of the Emergency Relief Appropriation Act were also engaged in various activities connected with this project in Florida and Puerto Rico. Under the supervision of the combined forces, 25,128,317 inspections or dippings of cattle, and 2,897,082 inspections or dippings of horses and mules, were conducted. In Puerto Rico, where the tropical variety of fever tick (*Boophilus annulatus* var. *australis*) is prevalent, it was also necessary to treat the sheep and goats on infested premises, and 571,973 inspections or dippings of these animals were conducted.

The following areas were released from Federal quarantine as a result of tick-eradication activities: One county, part of one county, and the remainder of one county in Florida; and six counties and parts of six counties in Texas. The aggregate area of the released territory was 12,088 square miles. In Florida, parts of three counties,

with a total area of 2,248 square miles, were requarantined. At the close of the year the area remaining under Federal quarantine in continental United States had been reduced to 4 percent of its original size and is now confined to parts of Florida and Texas.

Table 19 shows the progress made in tick eradication since its beginning in 1906 and gives the status of the work at the close of the year.

TABLE 19.—*Tick-eradication results July 1, 1906, to June 30, 1938*

State	Counties quarantined on—		Counties released to June 30, 1938	Released counties tick-free on Nov. 1—			
	July 1, 1906	June 30, 1938		1934	1935	1936	1937
Alabama	67	0	67	67	67	67	67
Arkansas	75	0	75	63	68	70	75
California	15	0	15	15	15	14	15
Florida	67	6	61	48	55	58	58
Georgia	158	0	158	158	155	158	158
Kentucky	2	0	2	2	2	2	2
Louisiana	64	0	64	16	24	29	42
Mississippi	82	0	82	74	77	79	82
Missouri	4	0	4	4	4	4	4
North Carolina	73	0	73	73	73	73	73
Oklahoma	61	0	61	61	61	61	61
South Carolina	46	0	46	46	46	46	46
Tennessee	42	0	42	42	42	42	42
Texas	198	21	177	130	127	137	149
Virginia	31	0	31	31	31	31	31
Total	985	27	958	830	847	871	905

FLORIDA DEER PROBLEM

The completion of tick eradication in Florida has been delayed in a few sections by tick-infested deer. To meet this situation, in 1937 the Florida Legislature enacted laws providing for the removal of ticky deer in four of the six counties in which tick-infested game preserves are located. At first the enforcement of these laws was vigorously opposed by some of the sportsmen of the State. They succeeded in obtaining an injunction restraining the State officials from carrying out the provisions of these special laws. Following a vigorous protest from the livestock interests in Florida and adjacent States, the injunction order was dissolved. Satisfactory headway is now being made in removing deer from these areas, and there are good prospects for the early completion of tick eradication on these game preserves. However, this problem continues in the two counties, Collier and Hendry, where there are infested game preserves that were not included in the State laws providing for the removal of the deer.

EMERGENCY RELIEF ASSISTANCE

Tick eradication in Florida and Puerto Rico again received valuable assistance through the allotment of funds from the Works Progress Administration and the Puerto Rico Reconstruction Administration. This assistance made it possible for Florida authorities thoroughly to reinspect and check conditions regarding tick infestation in much of the released area of that State. In Puerto Rico systematic tick eradication was conducted in the western third of the

island, where 300 dipping vats had been constructed in the previous fiscal year. In the middle third of the island 297 dipping vats were constructed during the current fiscal year, preparatory to beginning systematic work at an early date.

MOVEMENT FROM QUARANTINED AREA

In the enforcement of Department regulations governing the interstate movement of cattle and horses from areas quarantined for splenetic or tick fever, 144,768 cattle were inspected, or dipped and inspected, for which 4,961 certificates were issued authorizing their interstate movement as noninfectious. Horses and mules to the number of 7,964 were also inspected in the quarantined area, and 1,042 certificates were issued authorizing their movement from such areas. In connection with these movements, 52 cars were cleaned and disinfected.

HOG-CHOLERA CONTROL

Thirty veterinarians were assigned to the investigation and control of outbreaks of hog cholera and allied swine diseases. Through their visits to farms and attendance at meetings, these Bureau veterinarians had an opportunity for 60,458 farm inspections and consultations relating to their work with farmers, veterinarians, State officials, and others interested in the suppression of hog cholera.

Educational work on this project was continued by the veterinarians, who attended 276 meetings, at which there was an attendance of 28,265 persons. Demonstrations in the use and efficacy of the serum treatment were given in the treatment of 38,889 hogs. During the year 4,861 outbreaks of cholera were reported to Bureau veterinarians, an increase of 1,339 outbreaks over the previous year. Table 20 summarizes the activities.

TABLE 20.—*Summary of hog-cholera-control work, fiscal year 1938*

State	Meetings		Farm inspections and consultations	Post-mortem examinations	Hogs treated in demonstrations	Outbreaks reported to Bureau veterinarians
	Number	Attendance				
Alabama	11	910	2,733	107	0	59
Florida	9	885	2,554	19	13,080	44
Georgia	38	4,360	9,274	166	1,807	146
Idaho	4	276	464	29	0	17
Illinois	23	4,014	7,334	704	0	574
Indiana	22	1,417	1,543	38	0	241
Iowa	26	3,879	4,980	427	0	579
Kansas	4	26	838	51	0	86
Kentucky	16	460	6,596	178	0	218
Louisiana	0	0	767	16	3,574	46
Maryland	15	1,588	4,161	106	1,271	163
Michigan	0	0	42	5	237	76
Mississippi	5	110	479	1	384	0
Missouri	0	0	0	0	0	0
Nebraska	0	0	349	19	0	10
North Carolina	15	1,047	1,992	64	7,328	70
Ohio	4	525	962	204	0	408
Oklahoma	15	2,955	2,617	36	107	77
Oregon	0	0	156	10	15	2
South Carolina	6	733	1,236	69	8,501	218
South Dakota	0	0	720	12	0	164
Tennessee	28	1,310	2,282	195	446	1,315
Texas	14	265	2,758	32	0	203
Virginia	18	3,445	4,437	4	0	17
Washington	0	0	832	9	0	7
Wisconsin	3	60	352	69	2,139	121
Total	276	28,265	60,458	2,570	38,889	4,861

TUBERCULOSIS ERADICATION DIVISION

The work of eradicating tuberculosis from livestock was continued in cooperation with States, counties, and livestock owners. It was possible to conduct a large volume of work in connection with the tuberculin testing of cattle during the year, because of the addition of Federal emergency funds provided for it. Activities for the elimination of Bang's disease and Johne's disease likewise were conducted on a cooperative basis. The work of the Division was directed by A. E. Wight, Chief, and his assistants.

BOVINE TUBERCULOSIS

Most of the work done consisted in the testing of cattle under the area plan. Altogether, 14,108,871 tuberculin tests were applied to cattle. The percentage of reactors was 0.6, which was the lowest degree of infection found throughout the project, which began in 1917.

The Federal force of veterinarians was engaged to a considerable extent in supervising the field work performed by a large number of veterinarians employed with emergency funds. The work was conducted from 44 field stations. The State and Territorial authorities employed an average of about 300 veterinarians throughout the year; counties employed about 240 veterinarians on full time. An average of 236 emergency veterinarians were employed during the year, including those working at a per-diem rate, on a part-time basis, and 85 local helpers were employed to assist them in the field work.

Emergency funds for the cattle tuberculosis work amounted to approximately $1,775,000. This sum was used for both operating expenses and indemnities. The Federal indemnity payment with these emergency funds could be made to owners without requiring a similar or any payment from the cooperating States, Territories, or counties. The regular Federal appropriation for tuberculosis work during the year was $1,603,000, of which $499,884 was for indemnities and the remainder for necessary operating expenses. The combined State, Territorial, and county appropriations were approximately $4,000,000 during that period.

The maximum Federal payment for grade cattle was $25 and for purebred registered cattle $50. The average appraised value of reactors was $86.76. Of the total number of reactors on which Federal payment was made, 4 percent were purebred registered cattle. The average Federal payment was $18.12, and the average State payment $16.41. Of the Federal funds, about $1,334,000 was used for indemnity purposes, and the State funds for indemnity amounted to about $1,208,000.

At the end of the year 6,471,538 herds, containing 62,640,358 cattle, were under supervision for the eradication of tuberculosis. Table 21 shows that from 1917 to 1938, inclusive, 3,651,520 reactors were removed from the cattle herds of this country.

TABLE 21.—*Tuberculin testing under accredited-herd and area plans, 1917–38*

Year ended June 30	Cattle tested					Yearly increase of—			
	Accredited-herd plan	Area plan	Total	Reactors found and removed		Modified accredited counties	Herds accredited [1]	Herds passed 1 test [1]	Herds under supervision [1]
	Number	*Number*	*Number*	*Number*	*Percent*	*Number*	*Number*	*Number*	*Number*
1917	20,101	----------	20,101	645	3.2	--------	--------	----------	---------
1918	134,143	----------	134,143	6,544	4.9	--------	204	883	---------
1919	329,878	----------	329,878	13,528	4.1	--------	578	5,652	---------
1920	700,670	----------	700,670	28,709	4.1	--------	2,588	10,054	---------
1921	1,366,358	----------	1,366,358	53,768	3.9	--------	4,831	33,215	71,803
1922	1,722,209	[2] 662,027	2,384,236	82,569	3.5	--------	8,015	111,719	140,376
1923	1,695,662	1,765,187	3,460,849	113,844	3.3	--------	12,310	150,748	187,915
1924	1,865,863	3,446,501	5,312,364	171,559	3.2	38	19,747	216,737	305,809
1925	2,008,526	4,991,502	7,000,028	214,491	3.1	51	24,110	392,740	414,620
1926	1,989,048	6,661,732	8,650,780	323,084	3.7	109	24,009	382,674	435,840
1927	2,522,791	7,177,385	9,700,176	285,361	2.9	149	34,084	229,086	261,148
1928	2,589,844	8,691,646	11,281,490	262,113	2.3	180	38,880	427,595	473,218
1929	2,853,633	8,830,087	11,683,720	203,764	1.8	213	1,639	249,420	281,323
1930	2,953,350	9,892,521	12,845,871	216,932	1.7	236	11,863	227,921	347,448
1931	3,086,403	10,695,870	13,782,273	203,778	1.5	247	[3] 26,259	350,735	356,916
1932	3,131,426	10,312,131	13,443,557	254,785	1.9	220	18,049	252,988	303,832
1933	2,980,526	10,093,368	13,073,894	255,096	2.0	183	19,701	337,730	346,394
1934	2,826,257	12,293,506	15,119,763	232,368	1.5	189	31,460	342,262	387,969
1935	2,716,292	22,521,240	25,237,532	376,623	1.5	613	13,128	1,324,643	1,276,249
1936	2,193,015	20,725,023	22,918,038	165,496	.7	493	17,119	998,703	924,410
1937	2,274,337	11,475,971	13,750,308	94,104	.7	109	19,688	212,548	230,198
1938	2,598,868	11,510,003	14,108,871	89,359	.6	94	[3] 6,649	[3] 233,268	[3] 273,933
Total	44,559,200	161,745,700	206,304,900	3,651,520	1.8	3,124	269,095	6,034,795	6,471,538

[1] The figures in these columns represent net increases at the close of each year.
[2] Testing during 6 months.
[3] Represents decrease from figures for previous year.

Approximately 82 percent of all the cattle tested were handled under the area plan. The following States were added to the modified accredited area: New Jersey, New York, and South Dakota. The total number of States so declared on June 30 was 47. At the same time the modified accredited area included 3,124 counties. This number included 67 modified accredited areas in Puerto Rico and 1 in the Virgin Islands. More than 99 percent of the counties in the United States were in the modified accredited area at the end of the year. At this time also, 14 counties in California, the remaining nonaccredited State, were engaged in intensive testing.

TUBERCULOSIS IN POULTRY AND SWINE

The survey of farm poultry flocks begun several years ago in connection with the testing of cattle for tuberculosis was continued, and 127,912 flocks of poultry, containing 14,838,911 fowls, located in 11 States, were observed by the veterinarians in the field. As a result of such observations, infection was reported on about 6,000 farms.

As a separate additional project, about 15 Bureau veterinarians were assigned to the eradication of avian tuberculosis in the Midwestern and North Central States, where the disease is most prevalent. These employees visited about 9,000 farms and observed about 1,161,200 fowls. They reported infection on about 1,600 farms.

The result of tests of cattle for Johne's disease, or paratuberculosis, made with either johnin or avian tuberculin, showed that this disease existed to a slight degree in 10 States; 293 cattle, or 7.2 percent of the total number tested, were condemned on account of this disease.

TESTING CATTLE FOR INTERSTATE SHIPMENT

Approved veterinary practitioners throughout the 48 States continued to conduct testing of cattle for interstate shipment. On June 30 there were 11,085 veterinarians on the approved list. These men tested for interstate shipment about 16,000 lots of cattle containing about 177,362 cattle, of which 0.05 percent reacted. Testing done in connection with interstate shipment of cattle is included in the total testing reported in table 21.

BANG'S DISEASE

The work in connection with the elimination of cattle reacting to the test for Bang's disease was continued. The project was conducted in cooperation with the livestock owners and the livestock sanitary authorities and continued to be on a voluntary basis as far as the Federal Government was concerned. The owners were required to sign an agreement involving certain action on their part that was considered necessary in the proper handling of herds of cattle in the Bang's disease elimination project.

The maximum Federal payment for grade cattle, condemned as reactors, was $25 and for purebred registered cattle, $50. The owner received the salvage in addition to the Federal payment. In Delaware, Florida, Maine, Maryland, New Hampshire, New York, Pennsylvania, Virginia, Washington, and Wisconsin, he received an additional payment from the State for the cattle that were eliminated. In no instance does the owner receive from all sources more than the appraised value.

Approximately $8,725,000 was used for making Federal payments to owners for eliminated cattle, and the Federal operating expenses amounted to about $2,700,000. The States expended about $1,000,000 for indemnity in the Bang's disease project during the year, the total expenditure for State indemnity being about $1,300,000 since the cooperative work was undertaken in 1934. For operating expenses the States expended about $500,000, and the total State operating expenses since 1934 amount to approximately $1,500,000.

Agglutination blood tests for Bang's disease were applied to 7,837,363 cattle in 671,308 herds. A considerable number of these were retests. Of the total number of cattle tested, 324,532, or about 4 percent, were declared to be reactors to the test. During the previous fiscal year the percentage of reactors was about 5 percent.

The average appraisal for cattle reacting to the test for Bang's disease was $80.37; the average salvage, $32.07; the average Federal indemnity, $26.69; and the average State indemnity, $20.36. Of the reactors, 9 percent were purebred registered cattle.

In several States plans have been made to conduct the testing of cattle for Bang's disease on an area basis, and usually the area

consists of a county. In about 290 counties all the breeding cattle more than 6 months of age had been tested by this method to the end of the year.

DIVISION OF VIRUS-SERUM CONTROL

The Division of Virus-Serum Control, directed by D. I. Skidmore, Chief, continued to conduct regulatory and administrative work authorized by the Virus-Serum-Toxin Act. It also administered the marketing agreement for handlers of anti-hog-cholera serum and hog-cholera virus. This agreement was made effective December 7, 1936, by an order of the Secretary of Agriculture.

WORK AT LICENSED ESTABLISHMENTS

At the close of the year supervision was exercised over 76 licensed establishments, the same number as last year. These establishments were distributed among 54 cities and towns in 21 States. At the close of the year 36 establishments were engaged in producing only anti-hog-cholera serum and hog-cholera virus, 34 were producing other biologics only, and 6 were producing both classes of products.

Bureau inspectors examined 327,697 hogs and 646 calves intended for use in licensed establishments. Of these, 193 hogs were rejected at the time they were offered for admission, and 21,109 hogs were rejected because of conditions developing later that made them unsuitable for use. The total number of animal inspections was 2,105,735. Bureau inspectors supervised 3,308 potency and 2,667 purity tests of anti-hog-cholera serum and 2,117 purity tests of simultaneous virus.

OUTPUT OF BIOLOGICAL PRODUCTS

Table 22 shows the quantities of biologics produced by licensed establishments under the Bureau's supervision.

TABLE 22.—*Classes of biological products produced by licensed establishments, fiscal year 1938* [1]

Product	Quantity	Product	Quantity
Anti-hog-cholera serum cubic centimeters	741, 459, 176	Antitoxins (botulinus and tetanus) units	635, 370, 500
Other serums doses	3, 163, 688	Bacterins doses	35, 856, 725
Hog-cholera virus cubic centimeters	209, 852, 257	Diagnostics do	1, 760, 939
Other virus doses	65, 516	Toxins and toxoids do	21, 986
Aggressins do	5, 291, 148	Vaccines do	35, 298, 630
Antitoxins (antivenin) do	225		

[1] Detailed information regarding the production of products within these classes will be furnished on request.

PRODUCTS REJECTED

Table 23 shows the quantities of biological products found to be unfit for marketing. Most of them were rejected in the course of preparation, whereas others were recalled from the market and destroyed.

TABLE 23.—*Biological products rejected and destroyed because of unfitness for marketing, fiscal year 1938*

Product	Quantity	Product	Quantity
	Cubic centimeters		*Doses*
Anti-hog-cholera serum:		Abortion vaccine	25,155
From animals found diseased	1,777,160	Blackleg aggressin (cultural)	750
Contaminated and otherwise unfit	876,884	Blackleg bacterin	5,905
Hyperimmunizing virus (hog cholera):		Distemper, influenza, and pneumonia bacterin (equine)	2,000
From animals found diseased	4,468,310	Hemolyticus-bacillus bacterin	1,450
Contaminated and otherwise unfit	498,302	Laryngotracheitis vaccine	122,200
Simultaneous virus (hog cholera):		Pox vaccine	602,700
From animals found diseased	837,790	Rabies vaccine	3,388
Contaminated and otherwise unfit	1,548,634	Tuberculin	111,575
Total	10,007,080	Total	875,123

IMPORTS AND EXPORTS OF BIOLOGICAL PRODUCTS

The importation of veterinary biological products from foreign countries continued to be handled in cooperation with the Treasury and Post Office Departments and the Food and Drug Administration of the Department of Agriculture. At the close of the year two permits to import such products were outstanding. Fifty-nine shipments of biologics were offered for admittance to this country. Forty-nine of these, upon examination by Bureau inspectors, were found to be biologics that had been exported from the United States but were returned for various reasons. Two shipments were refused entry because they were not covered by permits; the remaining eight shipments were admitted.

Bureau inspectors issued 504 certificates to accompany shipments of veterinary biological products to foreign countries. These certificates covered the following quantities of products: Anti-hog-cholera serum, 8,333,200 cubic centimeters; hog-cholera virus, 562,005 cubic centimeters; aggressins, 354,206 doses; bacterins, 729 041 doses; diagnostic agents, 62,808 doses; antitoxins, 8,799,000 units; serums and antiserums, 43,151 doses; vaccines, 1,188,228 doses. The total quantity of anti-hog-cholera serum reported to the Bureau as having been exported aggregated 11,510.300 cubic centimeters. Additional exports of biological products, not covered by Bureau certificates and of unknown quantity, likewise were made to certain foreign countries that do not require certificates for such products.

SERUM-MARKETING AGREEMENT

At the close of the year 171 handlers of anti-hog-cholera serum and hog-cholera virus were operating under the provisions of the serum-marketing agreement and order. Of these handlers, 42 were producers, 127 were wholesalers, and 2 were volume contract purchasers. To June 30, 1938, seven formal complaints had been made by the control agency, established under the marketing agreement and order, and others against as many different handlers of serum and virus. In all of these it was alleged that the accused handlers were selling or offering to sell serum and virus at less than their posted prices. The selling of these products at prices less than those posted by the particular handler is prohibited by the serum-marketing agreement and order under a policy established by Congress.

The evidence in only one of these cases was deemed sufficient to warrant the Department in making an investigation of the complaint. The investigation has not yet been completed. Practically all handlers seem to feel that the marketing agreement has been successful in stabilizing the serum industry and in assuring the swine industry of an adequate supply of dependable anti-hog-cholera serum and hog-cholera virus at all times.

ZOOLOGICAL DIVISION

Basic research on animal parasites, testing of control measures, and experiments with drugs and chemicals to discover practical methods of destroying eggs and larvae of parasites in manure and of removing parasites from livestock and poultry were carried out under the direction of Benjamin Schwartz, Chief.

PARASITES OF HORSES

In a continuation of studies on the destruction by chemicals of parasite eggs and larvae in horse manure, stable manure in an outdoor double-walled box having a capacity of 11 cubic feet was treated with a mixture of isomeric dichloropentanes in proportions of 5 to 12.5 cubic centimeters of the chemicals per pound of manure. The treated manure was kept in the closed box about 30 hours to 7 days. In some tests there was appreciable self-heating of the manure during the storage period. The data obtained indicate that the treatment was effective in killing the eggs and preinfective larvae in the manure in some cases. For effective results the proportions of the chemicals to the manure or the exposure period apparently must be greater than that which proved adequate in small laboratory experiments described in last year's report.

Further experiments were made on the destruction of eggs and larvae of parasites in horse manure by the use of live steam. An insulated box, large enough to contain the daily manure output from a stable housing about 15 horses, was fitted with coils of a perforated pipe connected to a 1½-horsepower boiler generating steam under a maximum pressure of 25 pounds. For complete devitalization of eggs and larvae, it was necessary to maintain a temperature of 95° C. for one-half hour in the coolest portions of the box; the temperatures in other parts of the box were much higher. In comparatively warm weather the entire effective steaming process required 1½ to 2½ hours, depending on boiler pressure and the extent to which the manure was packed in the box. The temperatures actually attained in the box were found to be more important than the steaming time.

PARASITES OF RUMINANTS

TRICHOMONADS IN CATTLE

In investigations on trichomonads in cattle, seven virgin heifers were infected experimentally either by the inoculation into the vagina of live organisms from cultures or by the service of an infected bull. The following results were obtained: One heifer had a normal pregnancy followed by a normal parturition. In four heifers three to six services were required to produce conception, which was preceded by

an irregular oestrum and was delayed 3 to 6 months. One heifer had a delayed pregnancy, the final outcome of which had not been determined at the end of the year. One heifer developed pyometra, and about 20 quarts of fluid teeming with live trichomonads were aspirated from the uterus of this animal. Fourteen months after the initial breeding date this heifer still had intermittent vaginal discharges containing live trichomonads.

Four cows, each of which had recovered from an experimental infection with trichomonads and subsequently had borne a normal calf, were reinfected experimentally to determine whether the previous infection had conferred an immunity on them. These cows became positive following experimental infection, but the course of the infection was of rather short duration. The experiment with these animals is still being continued. A bull that became infected as a result of serving an experimentally infected heifer has already infected three heifers and six cows. The infection in the bull had persisted for 15 months at the end of the year. Attempts to inoculate the prepuces of bulls experimentally with cultures containing live trichomonads gave negative results in 20 trials.

Two cows, each of which had borne a normal calf, were found to be susceptible to an experimental infection with trichomonads produced by the service of an infected bull. This experiment also is being continued.

Since cattle are known to be infested with intestinal trichomonads, and since it has not been definitely determined whether they will live also in the genital tract of these animals, a survey was made to determine the prevalence of intestinal trichomonads in cattle and to obtain material for experimental transmission of these organisms to the genital tract. Of 17 cattle examined, all were found to be infested with the organisms. They were also isolated from the rumen, reticulum, cecum, and colon of a bull that was slaughtered at Beltsville, Md. The various strains of intestinal trichomonads are being cultured, and plans are under way to attempt experimental transmission of these organisms to the genital tract of bovines.

Since 1936, observations have been made on a dairy herd consisting of approximately 300 cattle. Of 10 bovines in which trichomonad disease was diagnosed microscopically, 2 were killed because of permanent sterility due to the infection, 1 died suddenly from an undetermined cause, 6 bore normal calves, and at the end of the year 1 was due to calve shortly. Of the six infected cows that bore calves, parturition was delayed for an average of 6 months, and five services, on the average, were required before conception took place. In 125 noninfected cows and heifers under observation, only two services, on the average, were required to bring about conception. In addition to the data given, 12 cases of trichomonad infection were discovered in cattle following daily examinations of vaginal smears of 204 cows and heifers. An infection was found in a cow that had previously recovered from trichomonad disease. This finding supports the results already given and shows that one infection does not confer an immunity to a subsequent infection. In the course of the observations on the herd just mentioned, a trichomonad infection was discovered in a virgin heifer. Similar observations were reported previously and it is evident, therefore, that trichomonad disease is not always acquired venereally.

By means of a questionnaire sent to State veterinarians and specialists in animal diseases, as well as by examinations of numerous samples forwarded to the Bureau, it was determined that trichomonad disease in cattle is present in the following States: California, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Iowa, Kansas, Kentucky, Maryland, Nebraska, New Jersey, New Mexico, New York, Ohio, Oklahoma, Pennsylvania, South Carolina, Texas, Utah, West Virginia, and Wyoming. The disease is apparently widespread, although in most instances cases of trichomoniasis are sporadic. The spread of this disease is due to the movement of cattle, particularly bulls lent as herd sires and infected cows brought to noninfected premises for breeding purposes. Once introduced into a herd, trichomonad disease spreads rather rapidly.

COCCIDIA IN SHEEP

Studies on coccidiosis in sheep were continued. Of 100 samples of feces from as many sheep examined for coccidia, 96 were positive. The seven species of coccidia known from sheep were found in these samples. *Eimeria arloingi*, a pathogenic form, occurred in 90 percent of all samples examined.

Experimental infection of a 7-week-old lamb showed that the incubation period lasted about 12 days and was followed by an acute diarrhea, weakness, and apathy, these symptoms persisting nearly 2 weeks. While the symptoms were present the lamb discharged large numbers of oöcysts with the feces. Nine lambs, kept under observation during the first few months of life, were found to be free from coccidial infection during the first 3 weeks. From the fourth to the sixth week numerous oöcysts were discharged with the feces, the period of greatest oöcyst discharge corresponding to the period that the lambs had begun eating off the ground. Following the heavy discharge of oöcysts by the experimentally infected lamb and by the lambs that became naturally infected, the infection tapered off to a low level and the host animals apparently became chronic carriers. Under favorable conditions about 97 percent of the oöcysts sporulated in 2 to 3 days and thus became infective to other lambs. Putrefaction, rapid drying, and prolonged high atmospheric temperatures prevented sporulation and ultimately killed the oöcysts. Optimum conditions for sporulation under natural conditions were present in fresh fecal pellets.

In attempts to alleviate the symptoms of coccidiosis in sheep, a dilute solution of iron sulphate and copper sulphate in water (6.2 grams of iron sulphate and 0.7 gram of copper sulphate per liter of water) was administered to a number of lambs daily for several months. The treated lambs passed fewer oöcysts, showed milder symptoms, gained weight more rapidly, and were in generally better condition than untreated controls. One of the latter died from coccidiosis, whereas none of the treated animals died or showed conspicuous symptoms of this disease.

ANAPLASMA

The principal objectives of investigations on anaplasmosis were to determine whether the progeny of ticks that had engorged on clinical cases of anaplasmosis were capable of transmitting this disease to

susceptible bovines, and whether it might be possible to detect carrier cases of anaplasmosis in a herd by injecting, into a recovered splenectomized bovine, blood from suspected cases. The common dog or wood tick (*Dermacentor variabilis*), the spotted fever tick (*D. andersoni*), and the brown dog tick (*Rhipicephalus sanguineus*) were placed on bovines known to be infected with anaplasma. The progeny of these ticks, in any stage of development, failed to transmit anaplasmosis to susceptible cattle. The tropical horse tick (*D. nitens*) engorged on a bovine known to be infected with anaplasma. Tests on the transmission of this disease through the progeny of this tick are still in progress. Two splenectomized cattle known to be carriers of anaplasma had a relapse following splenectomy. After the injection of virulent blood, these two cattle showed clinical symptoms again in 8 days. Repeated injections of virulent blood at suitable intervals produced a reaction each time. A relapse could not be elicited by the injection of the animals' own blood or by the injection of the blood of other splenectomized animals. These data indicate the possibility of detecting anaplasmosis in a herd by injecting composite samples of blood into a known carrier from which the spleen had been removed. Such splenectomized animals apparently may be used over and over again for the purpose indicated.

TREMATODES

Field investigations on liver flukes of cattle and sheep were continued in the Pacific Coast and Rocky Mountain States. The purpose was to discover foci of infection and to demonstrate effective methods of controlling these parasites by drainage of wet and boggy lands and by medicinal treatment of infested stock. In Montana the Bureau cooperated with the State Livestock Sanitary Board in demonstrating, in a number of selected areas, drainage as a control measure for liver flukes.

Post-mortem examinations for parasites were made of a large number of deer from Florida. The only species of liver fluke found in these animals was the large American fluke (*Fascioloides magna*). Examinations of cattle livers from areas in Florida in which infested deer were present showed, in all cases but one, that the flukes present were the common liver flukes (*Fasciola hepatica*). In the one exceptional case *F. magna* was found.

CESTODES

Following the announcement by an American parasitologist that the developmental stages of the common sheep tapeworm (*Moniezia expansa*) had been recovered from oribatid mites (*Galumna* sp.) which had been fed the eggs of this tapeworm, an investigation was undertaken to determine the conditions under which these mites live in sheep pastures. In the course of this investigation several species of mites were encountered, but species of *Galumna* were the least abundant. The intermediate mite hosts were present in all areas examined from October 1937 to May 1938 inclusive. They were most abundant, however, during April and May and were found especially in a low-lying pasture in which the grass was relatively long and apparently undergrazed. During clear weather the mites were found

to be most abundant early in the morning. On cloudy days they were about equally abundant at all times during the day. These observations indicate that sheep probably acquire the heaviest infestation while grazing early in the morning on clear days or while grazing on cloudy days, especially during the wet spring months.

Five infective larvae, isolated from as many mites, were fed at different intervals to a twin lamb, the other twin serving as a control. On post-mortem examination, 1 month after the first feeding, the experimental lamb contained two tapeworms of difference sizes, which corresponded to the age of the tapeworms as far as could be judged from the feeding dates. This work shows that the mites in question can serve as intermediate hosts of the common sheep tapeworm.

NEMATODES

Studies on the intestinal threadworm of sheep (*Cooperia curticei*) were completed. Under experimental conditions this parasite did not produce any serious pathogenic effects on the host animal. It was found, however, that infestation with these worms interfered to some extent with the utilization of feed by lambs.

The effect on sheep of experimental infections with nematodes (*Trichostrongylus* spp.), was very marked. Four lambs and three goats died as a result of experimental infection. These animals developed a severe diarrhea before death, which occurred 2 to 53 days after the onset of symptoms. Diagnosis of this infection by the examination of the feces for the parasite eggs was impossible since heavily infected animals died before the worms reached egg-laying maturity. Available evidence indicates that the pathogenicity of these worms is not associated with extensive hemorrhage in the intestinal tract since no anemia developed in the animals before death. Evidently the injuriousness of the worms was associated with certain marked changes in the chemical constituents of the sheep's blood, these changes being an increase in guanidine, blood sugar, and nonprotein nitrogen.

Under outdoor conditions at Beltsville the infective larvae of the common sheep stomach worm, the sheep threadworm, and *Trichostrongylus* spp. died for the most part during the winter months. The number surviving was negligible except in the case of *Trichostrongylus* spp., 6 percent of which survived. The larvae of *Strongyloides* of sheep died within a week after reaching the infective stage. These facts indicate that the survival on pastures of the larvae named is not nearly so important a factor in the carrying over of these nematode infestations from season to season as is the persistence of the worms in the stock.

ARTHROPODS

In a continuation of investigations on methods of controlling ox warbles, the following applications were tested: (1) A derris wash consisting of 1 pound of derris powder (5-percent rotenone content), 4 ounces of white flaked soap, and 1 gallon of water; (2) a rotenone wash consisting of soap and water as just stated and 1 ounce of rotenone in lieu 1 pound of derris powder. Of 1,152 warbles under the skin of 50 cattle, 1,114, or 96.7 percent, were killed by the derris

wash applied with a bristle brush, and of 768 warbles under the skin of 87 cattle, 582, or 75.8 percent, were killed by the derris wash applied with a soft cloth. Of 636 warbles under the skin of 50 cattle, 529, or 83.2 percent, were killed by the rotenone wash applied with a bristle brush, and of 276 warbles under the skin of 44 cattle, 170, or 61.6 percent, were killed by the rotenone wash applied with a soft cloth. These data show that the derris wash was superior to the rotenone wash and that the application of either wash with a bristle brush was more effective than with a soft cloth.

Investigations on the effects, on milk production, of infestation with ox warbles were terminated at the end of a 3-year trial. Results obtained, together with those given in last year's report, indicate that moderate infestations with ox warbles do not influence milk production.

Investigations on grub in the head of sheep were conducted in New Mexico and Texas. By means of compressed air, a 3-percent lysol solution was injected into the nasal passages of 12,215 sheep on the range. The maximum number treated per hour was 732. In controlled tests two lots of six sheep each were used. In lot 1, the sheep were treated while lying on their backs. In lot 2, they were treated in the standing position with the nose tilted upward and held in position in a special head rest. Lot 1 averaged only 1.2 grubs per animal after treatment, whereas untreated controls averaged 10.8 grubs per animal. Lot 2 averaged only 0.8 grub per animal after treatment, whereas untreated controls averaged 10.8 grubs per animal. These results indicate that a 3-percent lysol solution is an effective treatment for the removal of grubs from sheep and that the position of the animal while the treatment is administered is an important part of the technique of successful treatment.

Experiments were conducted to determine the effects on external parasites of sheep of a specially prepared finely divided sulphur applied as a dip. The results showed that the sulphur could be kept in suspension in the dipping vat, that sheep ticks disappeared from the dipped sheep but that lice were not eradicated, and that for several months after dipping the sheep showed evidence of sulphur in the fleece, which acted as a repellent to sheep ticks.

PARASITES OF SWINE

TRICHINAE

A continuation of investigations to determine the prevalence of trichinae in garbage-fed and grain-fed hogs yielded the following results. Of 2,847 diaphragms from hogs that had been fed garbage as collected, 286, or 10 percent, were infested with trichinae, the number of larvae in individual diaphragms ranging from 1 to 77,100. Of 3,799 diaphragms from grain-fed hogs slaughtered in Chicago and Kansas City, 40, or 1 percent, were infested with trichinae, the number of larvae in individual diaphragms ranging from 1 to 1,033. These data show 10 times as great an incidence of trichinae in hogs fed garbage as in hogs not fed garbage. They also show that the intensity of infestation with trichinae in garbage-fed hogs is much greater than that in grain-fed hogs.

Investigations were conducted to develop a satisfactory biological test for the diagnosis of trichinosis in living swine. The antigens in common use in connection with the intracutaneous tests on man yielded unsatisfactory results under conditions prevailing in a hog-slaughtering establishment. A new antigen, containing the metabolic products of live trichina larvae, has been prepared and is now being tested on hogs by the intracutaneous method. The results obtained thus far appear to be more promising than those obtained with other antigens.

An investigation to determine the effects, on the vitality of trichinae, of the exposure of infested pork to temperatures of −10° and −20° F. is still in progress. The results obtained thus far show that the continuous exposure for 8 days, to a temperature not higher than −10°, of infested pork in boxes not exceeding 6 inches in diameter destroyed the vitality of all trichinae in the pork. When the temperature to which the meat in the boxes was exposed was maintained continuously at not higher than −20°, the vitality of all the trichinae was destroyed in 5 days. Trichinous meat was also packed in tierces not exceeding 27 inches in diameter. A continuous exposure of the tierces to a temperature not higher than −10° destroyed the vitality of all the trichinae in the meat in 15 days. When the temperature to which the tierces were exposed was not higher than −20°, the vitality of all the trichinae was destroyed after exposure for a continuous period of 10 days. This work, as yet incomplete, is being continued in order to shorten, if possible, the present required period of refrigeration of pork for the destruction of the vitality of trichinae.

STOMACH WORMS

An investigation of the red stomach worm (*Hyostrongylus rubidus*) begun in Moultrie in the fall of 1936, was terminated early in 1938. The essential facts on the life history of this parasite were given in last year's report. Further studies on the ecology of the infective larvae showed that they survived on unshaded soil about 2 months and on shaded soil and at the base of grass approximately 3½ to 4 months. The worms produced small ulcers in the gastric mucosa. The ulcers appeared about 1 month after experimental infection and healed spontaneously in 2 to 4 months.

That the red stomach worm can be controlled to a marked extent by sanitation is shown by the following data collected during 18 months: Of approximately 1,500 hogs representing the general run of these animals that are raised in the southeastern part of the United States, 41 percent were found to be infested and 27 percent of these had stomach ulcers. Of 425 hogs that were raised under strict sanitary conditions with due attention to parasite control, only 16 percent were found to be infested, and of these only 1 had stomach ulcers. Of 274 hogs raised under improved swine-husbandry practices, but not in strict accordance with sanitation designed to prevent parasites, about 54 percent contained the red stomach worm, and 19 percent of these had stomach ulcers. A strict adherence to the sanitation system of swine management apparently controls stomach

worms nearly as effectively as it does kidney worms, roundworms, and other intestinal parasites of hogs.

KIDNEY WORMS

Field investigations on kidney-worm control in the Southeastern States were continued as in previous years. A careful study was made of 121 projects in southern Georgia with the following results: Of the livers of 771 hogs from 88 projects rated as good, 80 percent were passed for food, and of the kidneys only 4 percent showed kidney worms and lesions. Of the livers of 203 hogs from 33 projects rated as poor because in many cases older hogs were permitted to feed with pigs raised under the sanitation system, only 18 percent were passed for food, and of the kidneys 50 percent contained worms and lesions. These data show conclusively the value of sanitation in controlling kidney worms, which produce losses, through meat-inspection condemnations, ranging from 25 to 50 cents per hog.

PARASITES OF POULTRY

PROTOZOA

Since there is no known effective treatment for coccidiosis in chickens, experiments are under way to determine whether the symptoms of this disease can be checked by tonic treatment. In a number of tests, chicks were given daily for about 1 week a solution containing traces of iron sulphate and copper sulphate in water. The birds were then infected with a pathogenic species (*Eimeria tenella*) and the treatment was continued about 2 or 3 weeks longer. The treated birds gained more weight and eliminated significantly smaller numbers of oöcysts than the untreated controls. Moreover, the treated chicks had less hemorrhages than the untreated controls, as evidenced by the inspection of the feces. Practically similar results were obtained when chicks were exposed to natural infection by being placed on ground known to be contaminated with the oöcysts of *E. tenella*. In the latter tests, the iron sulphate and copper sulphate were added to the drinking water as follows: 100 grams of ferrous sulphate and 10 milligrams of copper sulphate were dissolved in 1 liter of water; 10 cubic centimeters of this stock solution was added to 4 liters of the drinking water, which was before the chicks at all times. Better results were obtained when the tonic was available to the chickens for about a week before these birds were exposed to infection than when the infection took place before the tonic was available.

In studies on trichomonads of poultry, a species of *Pentatrichomonas* was found in the liver of a turkey and in the livers of two chickens. These organisms were not associated in the liver with bacteria. *Pentatrichomonas* sp. was isolated from the digestive tract of chickens and turkeys. This protozoan was inoculated experimentally into the digestive tract of baby chicks and turkeys. Although the organisms produced heavy infestations as a result of experimental inoculation, they apparently produced no pathological effects.

CESTODES

To obtain information on the effects on chickens of infestation with a common tapeworm (*Raillietina cestillus*), 24 White Leghorns and 64 Rhode Island Reds were paired according to weight when these chicks were 2 to 4 weeks old, and one member of each pair was fed 200 to 1,000 cysticercoids of the species named. The other member of each pair was used as a control. The infected birds were kept separate from the controls but under similar conditions. Both groups were given water and the same mash. The birds were weighed at least once a week for 6 to 9 weeks. A few pairs of birds were kept under observation for 21 weeks.

The noninfected birds gained weight more rapidly than those infected, the difference in the mean gains being particularly striking during the first month after experimental infection. At the end of the fourth week the noninfected birds had gained 7.6 to 9.2 percent more weight than the infected birds. The infected birds drank 15 to 20 percent less water and ate about 5 percent less feed than the controls. The effects of the early stunting in growth continued through sexual maturity in the birds kept under observation for 21 weeks.

NEMATODES

In studies on gapeworms of poultry, turkeys were found to retain this infestation from 3 to 8 months, thus demonstrating that an infected turkey may carry this parasite from one season to another. Chickens probably play only a minor role in the perpetuation of gapeworm infestation since adult chickens were found to harbor gapeworms only rarely. Of 20 chickens experimentally infected when about 10 days old, only 1 retained the infestation nearly 5 months, 2 retained the infestation about 3 months, and the remaining birds lost the infestation in 6 to 8 weeks. Guinea fowls were found to be susceptible to gapeworm infestation, retaining the worms about 2½ to 3 months. Guinea fowls did not develop symptoms typical of gapeworm infestation. Attempts to infest adult domestic pigeons and ducks with gapeworms were unsuccessful.

Confirming the results reported last year, experiments involving 225 young turkeys showed that these birds developed symptoms of this infestation and began dying from it earlier than chickens. The number of pairs of worms developing and ultimately reaching the tracheas was proportionately greater in young turkeys than in young chickens, the inflammatory reaction in the tracheas of young turkeys being much more severe than in chickens.

Twenty-six birds that had been infested experimentally with gapeworms were superinfested 10 to 33 days after the first infestation. When the birds were killed in 2 to 3 weeks after the second exposure, only three contained in their tracheas worms of two different sizes. This indicates that one infestation does not confer an immunity in all cases against a later infestation. Under natural conditions turkeys are known to be susceptible to reinfection with gapeworms.

MISCELLANEOUS PARASITES

TREMATODES

Taxonomic and morphological studies of trematodes were continued. Several papers based on these studies, including descriptions of seven new species and four new genera, were published.

NEMATODES

Experiments to determine the possibility of destroying by chemicals the eggs of dog roundworms in kennels and runs were initiated. Preliminary tests showed that exposure of unembryonated eggs of *Toxocara canis* to the action of small quantities of ethylene dichloride or to a mixture of ethylene dichloride and carbon tetrachloride in closed containers prevented development and apparently destroyed the viability of the eggs in 46 to 94 hours. Infective embryonated eggs of *T. canis* exposed to the latter mixture for 90 hours in a closed container also were destroyed. Under similar conditions both carbon tetrachloride and a mixture of isomeric dichloropentanes were ineffective in preventing development of the eggs of *T. canis*. No conclusions can yet be drawn as to the practical value of these substances under kennel conditions.

MISCELLANEOUS IDENTIFICATIONS

Routine identifications of parasites were made during the year for various governmental agencies, educational institutions, and individuals. These identifications comprised about 250 nematodes and acanthocephalids. 200 cestodes, 700 trematodes, 500 ticks, and 50 miscellaneous arthropods and pentastomes.

TREATMENT FOR THE REMOVAL OF PARASITES

Preliminary experiments were carried on in cooperation with the Biochemic Division to develop an effective treatment for the removal of gapeworms from poultry. A number of chemicals were tried, but only one, barium antimonyl tartrate, was found to be highly effective for the removal of these worms from chickens under experimental conditions. The birds to be treated were confined in a battery jar in groups of three to six, and the chemical was dispersed in the confined space by means of a hand blower. This procedure resulted in the inhalation by the chicks of the powdered barium antimonyl tartrate, which removed, on an average, 98 percent of the gapeworms from the trachea. The same technique for the removal of gapeworms from turkeys resulted in an efficacy of only about 70 percent. With an improved technique, which is still being tested, the efficacy was increased to about 85 percent.

In investigations designed to develop satisfactory anthelmintics for the removal of tapeworms from poultry, a number of preparations were tested. Synthetic isopelletrine removed *Raillietina tetragona*, including the heads, from five chickens, but was ineffective for the removal of a closely related species (*R. cesticillus*). The latter species is more common and probably more injurious. Phenothiazine

administered with the mash failed to remove tapeworms from chickens. This chemical was fed to four chickens at a dose rate of 1 percent of the entire mash. Two days later each bird was given 12 cysticercoids of *R. cesticillus* with negative results. Evidently the chemical, administered before the cysticercoids, prevented infestation, since tapeworm infestation was readily produced in control chickens fed cysticercoids from the same lots that were administered to the treated birds. A reduced dose rate of phenothiazine administered with the mash was ineffective in preventing the development of tapeworms in the intestines of chickens. Although phenothiazine in an effective dose rate appeared to prevent tapeworm infestation, this chemical has the disadvantage of retarding the growth of chickens.

Phenothiazine at a dose rate of 1 gram per kilo of live weight was tested as an anthelmintic for the removal of internal parasites from swine. In two cases this chemical, administered in capsules, removed all the ascarids and nodular worms harbored by the host animals. A reduced dose rate of the chemical resulted in a decreased anthelmintic efficacy.

Butyl chloride, cupric arsenate, copper sulphocyanate, and diheptanol peroxide were tested as anthelmintics in swine. These chemicals were found to be either partially effective or wholly ineffective for this purpose.

INDEX CATALOG AND COLLECTIONS

The index catalog of medical and veterinary zoology was maintained in its various forms, 32,806 cards being added to the author, subject, and host catalogs and the check list of specific and subspecific names. The B section of the author catalog was issued and the C section sent to the printer. The D section is in preparation.

Of 628 lots of specimens added to the helminthological collections, 483 were entered under the Bureau of Animal Industry collection and 145 in the collection of the United States National Museum.

U. S. GOVERNMENT PRINTING OFFICE: 1938

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REPORT OF THE CHIEF OF THE BUREAU OF BIOLOGICAL SURVEY

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1938

REPORT OF THE CHIEF OF THE BUREAU OF BIOLOGICAL SURVEY, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF BIOLOGICAL SURVEY,
Washington, D. C., August 29, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I present herewith the report of the Bureau of Biological Survey for the fiscal year ended June 30, 1938.

Sincerely yours,

IRA N. GABRIELSON, *Chief.*

CONTENTS

	Page
Introduction	1
The importance of land for wildlife	1
Chief features of the year	4
Public informational work	7
Funds available	7
Organization	8
Research on wildlife status and management	8
The waterfowl situation	8
Banding game and other birds	11
Records of bird distribution	13
Studies of wildlife in relation to forests and ranges	13
Biological investigations on wildlife refuges	14
Wildlife-management research	14
State biological surveys and faunal reports	18
Economic research on wildlife	18
Waterfowl-food investigations	19
Mosquito control in wildlife habitat	21
Laboratory research in food habits	21
Cooperative food-habits research	23
Field investigations of game birds	23
Field studies of injurious nongame species	24
Research in fur-animal conservation and utilization	26
Developments in fur production and the fur trade	26
Cooperative investigations	26
Fur animal experiment station	28
Rabbit experiment station	30
Fur animal field station	31
Wildlife-disease control	32
Fur-animal diseases	32
Duck-sickness control	32
Maladies of propagated game birds	32
Federal aid in wildlife restoration	32
Acquisition of lands for refuges	33
Restoration of wildlife habitat by the refuge program	38
Restoration of wildlife habitat—Continued.	
Refuge development by C. C. C. camps	38
Cooperation of the Works Progress Administration	40
Cooperation of National Youth Administration	41
Engineering work for refuge development	41
Biological development of refuge areas	41
Administration of national wildlife refuges	43
Patrol and maintenance	43
Bird refuges	43
Big-game preserves and ranges	51
Administration of wildlife-conservation laws	54
Regulatory action	54
Work of game-management agents	55
Violations and penalties imposed	57
Court action on baiting cases	59
Importation and other permits issued	60
Foreign species excluded	60
Migratory birds excluded	60
Species entered under permit	60
Permits under the Migratory Bird Treaty Act	62
Cooperative control of injurious animals	62
Predatory-animal control	63
Rodent control	64
Supply depot and laboratory	65
Control methods research	66
Repellents and fumigants	66
Rodent and predator studies	66
Hawaiian rodent-control project	66
Wildlife conservation in Alaska	67
Alaska game law amendments	67
Changes in regulations	67
Law enforcement	67
Wildlife-restocking projects	68
Predator control in the Territory	68
Research on Alaska wildlife	68

INTRODUCTION

THE IMPORTANCE OF LAND FOR WILDLIFE

The wildlife-restoration program of the Bureau of Biological Survey, which was materially advanced during the past year, is fundamentally one of land utilization. In carrying out this program the

Bureau takes into account the fact that the major use of land in our present economy is agricultural. At the same time it is fully cognizant of the fact that the establishment of refuges for birds and other wild animals need not interfere with agricultural development. Fortunately, through the cooperation of those concerned with land use planning, it has been possible in the Government's purchases of submarginal lands to make provision for wildlife. When some other use of acquired lands is not primary, the Survey attempts to see that wildlife restoration is recognized as either the primary or a secondary, but still important, use. Fortunately also, the public generally is coming to realize that wildlife has a definite place in the land use program. As a consequence, in many sections game species especially are benefiting by the active cooperation of owners of submarginal acreage, who, in cooperation with the Bureau, are devoting large and small areas, particularly of marshland, to the welfare of waterfowl and other native forms of wildlife dispossessed by man of their primeval homes.

Necessary farming and industrial operations have justified economic uses of certain former wildlife habitat, but, unfortunately, unwise and unsuccessful drainage has ruined many extensive submarginal lands that had greater use to man in their natural state—teeming with the wild game and fur species thereby supported—than when unsuccessfully "reclaimed" for agriculture. Many such areas have been restored to wildlife during the year.

When an area has been acquired for refuge purposes, the first concern, as a rule, is to repair the natural hydraulic system and restore the original water levels, a measure that reverses the engineering program formerly in vogue of getting water off the land as completely and as expeditiously as possible. Following restoration of water levels, efforts are made to regenerate the native vegetative cover, by transplanting or, when necessary, introducing extirpated or other suitable species. Much of the vegetation of this type does not require a highly fertile soil. Hence, land too poor to yield an agricultural crop is being utilized for wildlife, and the development is being done in large part by employing relief labor.

The restoration of wildlife habitat is being aided by two important Federal laws, and work for the management of migratory species is undertaken under a third act of Congress with a view to providing an annual harvest for human enjoyment of the game and of the health-giving recreation to be found in the wildlife domain of forest, field, and stream. These three laws were enacted in furtherance of international treaty obligations for the conservation of species that live at different seasons in various parts of this country and also either in Canada or Mexico.

One of these laws is the Migratory Bird Hunting Stamp Act of 1934. This supplements the Migratory Bird Conservation Act of 1929, authorizing the acquisition of wildlife refuges, and provides part of the funds needed in the refuge program. As prescribed by its terms, every true sportsman over 16 years of age purchases a $1 stamp, validates it with his signature, and has it in possession while he hunts migratory waterfowl. The proceeds from the sale of the stamps, totaling more than $780,000 this year, are among the funds available for financing the refuge program and are supplemented by emergency relief allotments for restoration and development.

A second law, passed this year, known as the Pittman-Robertson Act, is designed to provide Federal aid to the States in their wildlife-restoration projects by authorizing annual appropriations of amounts equal to the revenue from the 10-percent tax on arms and ammunition, which has averaged about $3,250,000 annually. For the first year's operations the 1939 Agricultural Appropriation Act included an item of $1,000,000. The funds allotted therefrom to the States will be on a cooperative basis, each participating State paying one-fourth of the total cost of restoration projects approved by the Chief of the Biological Survey, acting for the Secretary. The projects thus aided by Federal contributions of three-fourths of the total cost will be supervised by the Biological Survey during development. With the States required and encouraged to acquire and develop land for wildlife purposes, many millions of acres will be gradually added to the total area being made available for wildlife under the national refuge program.

The third act referred to is the Migratory Bird Treaty Act of 1918, under which the Survey not only conducts research as a basis for adoption by the Secretary of regulations governing seasons and methods of hunting, bag limits, and possession of migratory birds, but also proceeds with their administration through educational work and law enforcement. For many years waterfowl have been in a precarious situation. Drainage of millions of acres has deprived the birds of large areas of their natural habitat, and improved roads and better means of transportation have made them easier to hunt. The birds each fall have had to run the gantlet of increasing numbers of hunters armed with ever-improved guns, and in addition throughout the year they have to withstand natural losses from predators, disease, and drought. Of all these limiting factors the one that can be most effectively controlled is the annual kill by hunters. Although drained areas are being restored and refuges are being established and maintained where waterfowl can breed, feed, and winter in safety, the success of any wildlife-conservation program depends on the adoption and observance of proper hunting regulations. Without this there would not be a sufficient return each spring of the breeding stock to occupy the nesting grounds dedicated to them and maintain the supply for succeeding years.

Regulations governing waterfowl hunting have had to be drastic for the past few years and have been as strictly enforced as possible. The result has been a noticeable increase of waterfowl, and this year the prospects are the best the birds have had since their recent precipitous decline. Some liberalization in the regulations, therefore, has been possible, so as to distribute more equitably such hunting as can be allowed, but there is still great need for restraint in hunting and for adopting somewhat drastic regulations and enforcing them effectively. The restrictions may seem unjust to some hunters, but it is to be remembered that an adequate game-law-enforcement program is necessary if waterfowl hunting is to be perpetuated.

Plans for wildlife restoration have been developed over a period of more than half a century of research and of field observations made by technicians of the Survey's staff. Facts slowly accumulated have been so brought together that when at last the means to proceed with a restoration program were provided the essential needs were known, as well as the methods by which they could be

met. The principal need, as already stated, is for land, and the minimum requirements for waterfowl were ascertained to be about 7,500,000 acres, distributed over marsh and water areas on the nesting grounds in the North, along the migration flyways, and on the southern wintering grounds. At the end of the year about half the total area required had been obtained or was in process of acquisition. The areas making up the remainder are known and can be acquired as the means are provided.

The second need is for more intensive and comprehensive research. The new national consciousness of the need for rededicating to wildlife some of the land and water areas that man has unwisely put to other uses places a great responsibility upon the Bureau of providing factual information regarding the animals that are to be benefited and the management of their environment. Fortunately, interest in the fauna and flora of the Nation has been manifest from the earliest days of settlement, and the constantly accelerated volume of contemporary literature shows that the interest each year is becoming more intensified. Gleaning data from a mass of published works and augmenting them by the original studies made by the regular personnel of the Survey and a selected corps of volunteer cooperators is a task of the first magnitude. During the year the study of the distribution and changing status of migratory birds has progressed in a most gratifying manner, and while the activities have continued to be concentrated to a large extent on migratory waterfowl, the results obtained have been of more than ordinary importance.

The third recognized need is for a personnel trained in wildlife management. There has long been a serious lack of men qualified to administer the country's resources in migratory and resident wildlife. Through recent cooperative undertakings, however, 11 of 15 prospective units for regional wildlife research have been established through the initiative of the Bureau with cooperating organizations at selected land-grant colleges, and these will offer to graduate students courses in wildlife administration similar in purpose to those offered in forestry. As the desideratum in wildlife management is the provision of an annual surplus for human enjoyment and utilization, it is essential that hunting shall not be permitted to an extent that will endanger the breeding stocks of any game species. The wildlife administrators developed for future work will have always to keep in view the objective of preventing the extermination of any species of wildlife and the desirability of increasing the numbers of all species to the greatest extent consistent with the land-use requirements of the human population. The work of the Biological Survey during the year has been motivated by this dual purpose.

CHIEF FEATURES OF THE YEAR

The outstanding features pertaining to the Bureau's work of the year may be summarized topically as follows:

National Wildlife Week.—That wildlife may be restored for the present generation and perpetuated for posterity, the President proclaimed the week beginning March 20, 1938, as National Wildlife Week, appealing to all citizens to recognize the importance of the

problem of conservation of the wildlife assets and to work with one accord for their proper protection and preservation.

Reorganization.—Bureau reorganization included establishment of the Division of Construction and C.C.C. Operations and the Division of Predator and Rodent Control by separation from other divisions; plans for the establishment of a new Division of Federal Aid in Wildlife Restoration; consolidation of all refuge-restoration and administration work in a single Division of Wildlife Refuges; and putting 6 of the 10 regional offices in full operation.

WILDLIFE RESEARCH

Waterfowl habitat.—The discovery of adequate habitat on the west coast of Mexico for waterfowl that formerly wintered in California and of the winter quarters of many ducks and geese of the Central flyway in the Mexican part of the Laguna Madre on the Gulf coast emphasized the importance to waterfowl-restoration programs of the treaty of 1937 with the neighboring Republic.

Research centers.—Completion of the laboratory at the Wichita Mountains (Okla.) Wildlife Refuge enabled the Bureau to institute a full program of study of wildlife relationships to forest and range; and progress of a construction program on the Patuxent (Md.) Research Refuge permitted the beginnings of systematic wildlife research there.

Research reports.—An extensive monograph on the ground squirrels was published as No. 56 of the Bureau's technical series, the North American Fauna, and a comprehensive report on the ecology and management of the blue-winged teal was issued by the Iowa cooperative research unit.

Aleutian Islands survey.—A biological reconnaissance was completed of the Aleutian Islands Bird Refuge, specimens of the fauna and flora were collected, animal life filmed, and data partly prepared for publication.

Farm wildlife management.—Completion of a survey in 48 States indicates that game management as a supplementary farm enterprise has varying degrees of success, the sociological aspects at present being more important than the economic.

Mourning dove studies.—A new approach to the problem of fixing open seasons on mourning doves was developed by studying the breeding cycle to learn when the majority of the adult birds have finished breeding and when the young have attained sporting size.

Drainage in wildlife habitat.—Quarterly quadrat counts were begun on nonmicroscopic faunas in adjacent ditched and natural marshes, to determine the actual biological effects of methods now employed in mosquito-control projects; and arrangements were made whereby the Survey will pass on drainage projects submitted to the Works Progress Administration.

Fur-research equipment.—A new fur-animal field station was established for muskrat investigations at the Blackwater (Md.) Migratory Bird Refuge; and through W. P. A. cooperation a new office and laboratory building was completed for the Fur Animal Experiment Station, N. Y., and nearly 500 experimental pens were constructed there for minks and foxes.

Reproduction in minks.—Financed by Bankhead-Jones research funds a cooperative study was begun of the reproductive cycle in the mink.

Fur-farming survey.—To assemble basic statistics on fur farming, including numbers of operators and value of stock and equipment, a Nation-wide inquiry was begun by means of questionnaires.

Waterfowl-disease research.—Studies of environmental conditions favorable to the development of botulism (duck sickness) in waterfowl disclosed the character of ooze, salinity, and organic disintegration most conducive to the inception of the malady.

NATIONAL WILDLIFE REFUGES

Refuges established.—Five national wildlife refuges were acquired, aggregating 13,676 acres and ranging in size from 100 to 6,800 acres; of these 1 was by purchase, at an average price of $26.15 an acre, and 4 were reserved from public domain by Executive orders; 17 new refuges were placed under administration.

Easement refuges.—The program of waterfowl restoration by establishing easement refuges was extended to South Dakota, and now in three States 81 projects are under construction or have been completed, involving refuge areas aggregating 135,113 acres.

W. P. A. cooperation.—Works Progress Administration allotments of $1,583,686 were used for developing 73 refuges in 21 States, chiefly on waterfowl flyways.

C. C. C. development work.—The Civilian Conservation Corps camps assigned to the Bureau for development work on wildlife refuges reached a total of 35.

LEGISLATION AND REGULATION

Federal aid to States.—Shortly after the approval on September 2, 1937, of the Federal Aid to Wildlife Restoration Act, organization plans were perfected and arrangements made for passing on wildlife-restoration projects and disbursing funds to States, beginning in the next fiscal year.

Law enforcement.—Successful prosecutions of violators commercializing game and conspiring to transport pelts illegally, increased enforcement of hunting regulations, and gratifying cooperation from State agencies combined to effect greater observance of wildlife conservation laws throughout the country.

Court decisions.—Circuit courts of appeal in Illinois and California affirmed lower-court decisions sustaining the power of the Secretary of Agriculture to make regulations that do not permit taking migratory waterfowl by means of feed or bait; and the United States Supreme Court denied applications for writs of certiorari in two of these cases.

Alaskan wildlife.—An amendment of the Alaska Game Law during the closing days of the last Congress will give more adequate protection to the wildlife resources of the Territory, and to the same end the regulations of the Secretary of Agriculture thereunder were revised; more intensive enforcement of the law and the regulations has brought an increased number of violators into court.

PREDATOR AND RODENT CONTROL

Predatory animals.—Greater protection to domestic livestock and game animals and birds and lessened possibilities of the outbreak and spread of rabies resulted from the destruction of 94,040 predatory animals in cooperative campaigns.

Rodents.—For the control of economically injurious rodents, 29,204,282 acres were treated under Bureau supervision, to protect farm crops, orchards, ranges, and water-diversion systems and to assist in checking soil erosion; in the New England States cooperation in the control of orchard mice was made more effective by the development of improved methods.

Sylvatic plague.—The Bureau inaugurated more intensive work in rodent control in areas reported by the United States Public Health Service as newly discovered plague centers in Nevada, Utah, Montana, Oregon, Idaho, and Washington.

Supply depot.—Enlargement of the supply depot at Pocatello, Idaho, will facilitate predator and rodent control by providing more ample storage space for bait materials and laboratory quarters for developing improvements in control products and equipment.

Selective control.—Laboratory and field studies resulted in further selectivity in controlling harmful wildlife by giving maximum protection to beneficial and harmless species in areas being covered for the control of injurious forms.

PUBLIC INFORMATIONAL WORK

The Bureau continued to make available to the public the results of its wildlife research and the progress of the wildlife-restoration program and of experiments in the propagation of economically useful species, as well as features of conservation-law enforcement and of necessary control of injurious forms of wildlife. Among the means employed were contributions to the various series of publications of the Department, including posters; the issuance of mimeographed leaflets to supplement correspondence, references to the several numbers of which are made under appropriate headings in the following pages; and preparation of press statements, radio and other addresses, and such visual information as motion pictures and exhibits. Through members of the technical staff the Bureau has been represented during the year at gatherings of scientists and educators, conservationists, sportsmen, wildlife managers, fur farmers, stockmen, and others interested in the protection, propagation, utilization, and control of the Nation's resources in wildlife and has thus had opportunity to present in detail to special groups much of the information summarized in this report. The first 99 issues of the mimeographed Wildlife Research and Management Leaflets were summarized in Leaflet BS–100.

FUNDS AVAILABLE

From regular and emergency appropriations a total of approximately $6,300,000 was available for the work of the Survey for the year. Of this sum, $2,002,840 was carried in the Agricultural Appropriation Act for regular activities; an estimated total of $780,000 has been collected from sales of Federal migratory-bird hunting stamps; and $19,700 was allocated to the Bureau from the Bankhead-Jones special research fund for an economic study of wildlife as a supplementary farm enterprise and for investigations of the reproductive cycle of the mink, silver fox, and muskrat. There was allocated from the Emergency Relief Appropriation Act of 1937, $1,583,646 to conserve water and wildlife, to check floods and erosion, to increase fur production, to provide stable water supplies, and to establish Federal waterfowl refuges in 22 States, and $45,300 was allocated for resulting administrative expenses. For expenditures in connection with work performed by the C. C. C. on national wildlife refuges, a total of $1,873,631 was made available to the Bureau.

ORGANIZATION

Effective February 1, further reorganization within the Bureau replaced the former Division of Migratory Waterfowl by the Division of Wildlife Refuges, in which are consolidated the administration of both bird refuges and big-game preserves; established the Division of Construction and C. C. C. Operations; and separated one unit from the Division of Game Management as the Division of Predator and Rodent Control. The change better coordinates related activities and provides competent individual administration for each natural unit of the work, and thus makes for increased efficiency. Arrangements were completed for the establishment of a Division of Federal Aid in Wildlife Restoration with the beginning of the new fiscal year to conduct the work authorized by the Pittman-Robertson Act.

At the close of the year there were in full operation 6 of the 10 regions into which the United States, including Alaska, has been divided for the purpose of decentralizing administration of field functions other than those involving wildlife research, land acquisition, and inspection of importations of foreign wild animals.

The present divisional and regional organization and the officers in charge are as follows:

Chief of Bureau	Ira N. Gabrielson
Associate Chief	W. C. Henderson
Division of Administration	W. R. Dillon
Division of Public Relations	H. P. Sheldon
Division of Wildlife Research	W. B. Bell
Division of Federal Aid in Wildlife Restoration [1]	A. M. Day
Division of Land Acquisition	Rudolph Dieffenbach
Division of Wildlife Refuges	J. C. Salyer, II
Division of Construction and C.C.C. Operations	H. W. Terhune
Division of Game Management	W. E. Crouch
Division of Predator and Rodent Control	Stanley P. Young
Regional organization (with directors and headquarters):	
Region 1 (Pacific), Portland, Oreg	Wm. M. Rush
Region 2 (Mountain), Denver, Colo	Leo L. Laythe
Region 3 (Southwestern), Albuquerque, N. Mex	Donald A. Gilchrist
Region 4 (West Central), Des Moines, Iowa	George Tonkin
Region 5 (Southern), New Orleans, La	Roy Moore
Region 6 (East Central), Milwaukee, Wis	Daniel H. Janzen
Region 7 (Southeastern), Atlanta, Ga	James Silver
Region 8 (Northeastern), Boston, Mass	S. B. Locke
Region 9 (Plains), Omaha, Nebr	Burnie Maurek
Region 10 (Alaska), Juneau, Alaska	Frank Dufresne

VETERAN RETIREMENTS

Automatic retirements of veteran workers were three in number, all from the Washington office and all on March 31, as follows: Jane S. Elliott, draftsman, after 27 years' service, all with the Bureau; Mary P. DeKnight, stenographer, after more than 20 years' service, the last 18 years with the Survey and earlier service with the War Department and the Forest Service; and Rosa E. J. Koch, file clerk, also after more than 20 years' service, nearly 14 of which were with the Bureau, following 7 years with the Treasury Department.

RESEARCH ON WILDLIFE STATUS AND MANAGEMENT

THE WATERFOWL SITUATION

INVESTIGATIONS IN CANADA

Under the leadership of the four flyway biologists of the Survey, parties were again this year sent to the waterfowl breeding grounds in Canada. Their reports are thrilling accounts of scientific exploration. The party on the Pacific flyway, the two on the Central, and that on the Mississippi flyway found that thousands of square miles of the great marshes of northern Canada are in excellent condition for waterfowl, and that, though these areas are still greatly underpopulated, there was a small but marked increase in the numbers of nesting birds over those observed in 1936. The party on the Atlantic flyway reported a definite increase in black ducks and Canada geese. At the close of the fiscal year, after investigations in the Southern States and Mexico, the

[1] Effective July 1, 1938.

four flyway biologists were again on the breeding grounds in Canada and Alaska.

In the Pacific flyway investigations were concentrated in British Columbia, which probably has never produced waterfowl in numbers comparable with areas of similar size in the Prairie Provinces. Nevertheless, this Province does make a notable contribution to the continental stock of birds. The breeding grounds there have not been materially affected either by climatic conditions or agricultural activities, the principal adverse factor being overshooting, as it is also in the Pacific Coast States. In British Columbia the survey investigators found the nesting habitat in good condition and the aggregate waterfowl population somewhat greater than in 1936.

In Canada the Central and Mississippi flyways converge and overlap, so they may be considered together. In the great central breeding grounds three parties took the field. The westernmost, operating in Alberta and western Saskatchewan, northward to Lake Athabaska, and west to Fort St. John, British Columbia, found little if any improvement over conditions of the preceding year. Drought throughout the southern half of Alberta and Saskatchewan was much worse than in 1936 and made great inroads also into the bush country. Fortunately, most of the parched area was dry or nearly so at the time of the spring migration and thus did not induce the waterfowl to begin nesting, as they sometimes do, only to lose their broods when the shallow waters later dry up. That this formerly valuable part of the breeding grounds may be permanently lost to the birds is indicated by the fact that the areas devoted to the four major cereal crops of Alberta alone (wheat, oats, barley, and rye) increased from about 600,000 acres in 1906 to more than 16,000,000 acres in 1935. Any water that may become available will undoubtedly have to be used to aid this greatly increased agricultural production.

The western party also investigated waterfowl botulism, which appeared on several small sloughs, and the seeming destruction of birds by leeches, which are abundant in some of the lakes. Studies of the common loon, a species that has been accused of destroying young waterfowl, indicate that it seldom if ever molests ducklings. It was rather surprising also to learn that little or no damage to young ducks is chargeable to the pike, or jackfish, so abundant in northern waters. It was found that some damage was done to birds by fires and also by Indians and their dogs.

The party working in eastern Saskatchewan and Manitoba found the situation much more satisfactory there than farther west, although unfavorable conditions were not lacking. High winds in Manitoba during the first week in June so raised the waters of the Netley and Delta marshes and at the south end of Lake Winnipegosis as to destroy large numbers of nests. The birds, however, nested again, and their second sets of eggs, while somewhat smaller, were successfully hatched. This party worked north in Manitoba to The Pas area and in Saskatchewan to Regina. Its general conclusion was that there should be a slightly increased crop of most species of ducks.

The biologist of the Mississippi flyway again began work in the delta of the Athabaska River and pushing northward along the Mackenzie by way of Great Slave Lake, Great Bear Lake, and the Barren Grounds south of Coronation Gulf, finally established summer headquarters at the Eskimo village of Aklavik in the Mackenzie delta. The spring break-up on the Mackenzie was followed by one of the worst floods in the history of the district, with water levels as much as 15 feet above normal. All nests then built were lost, and because of the shortness of the season the percentage of birds able to renest was small. A gratifying increase in waterfowl was noted in the Athabaska delta, a feature of particular satisfaction being the greater number of canvasbacks observed.

In the Atlantic flyway work was concentrated in the Maritime Provinces of Nova Scotia and New Brunswick. There, besides noting a definite increase in the numbers of black ducks and Canada geese, an important discovery was made of the presence of many breeding ring-necked ducks, heretofore considered as confined during the nesting season chiefly to the northern prairies.

Through the cooperation of the Newfoundland Government an aerial reconnaissance was made in that Colony as a basis for future work. The round trip extended about 400 miles within the island, affording an excellent idea of the waterfowl habitat, some of which looked promising but about which little is at present known, as it is remote from highways and railways. The black duck

seemed to be increasing slowly there, and the Canada goose is maintaining its numbers satisfactorily.

Returning to the United States late in June the Atlantic flyway biologist joined the MacMillan Arctic Expedition and accompanied it to northern Labrador and Baffin Island.

INVESTIGATIONS IN MEXICO

In western Mexico the biologist of the Pacific flyway conducted investigations as far south as Lakes Chapala, Patzcuaro, and Cuitzeo, covering the Valley of Mexico and all important areas west of the mountains. A mixed river, lagoon, and saline marsh area extends from Mazatlan to San Blas, a distance of 100 airline miles, and in this district the irrigation projects in the Yaqui, Mayo, Fuerte, Sinaloa, and Culiacan River Valleys form a most valuable wintering ground for migratory waterfowl, including Canada and white-fronted geese, as well as sand-hill cranes. In one section was observed a tremendous concentration of waterfowl, estimated at not less than 250,000 birds. The birds formed a continuous flock over a distance of 3 miles. In other sections estimates of 5,000 and 10,000 birds were commonly made. These facts demonstrate that the important wintering ground of the Pacific flyway is in western Mexico, rather than in California. While this had been surmised, it nevertheless is a satisfaction to know just where these birds have their winter quarters and that conditions are so favorable for them in our neighboring republic.

In eastern Mexico the biologist of the Central flyway worked as far south as Mexico City, but devoted most of his attention to the States of Vera Cruz and Tamaulipas, particularly to the Laguna Madre and other coastal waters south to Tampico. Early in February he made an aerial reconnaissance covering approximately 1,000 miles from Matamoros south to the Tamiahua Lagoon, in the State of Vera Cruz, flying almost the entire distance at the dangerously low altitude of 100 feet or even less. As most of that section is virtually inaccessible from the ground and its value to wintering waterfowl has only been surmised, his observations are particularly valuable. He estimated the waterfowl population of the area at 2,120,000, the list of birds being headed by the pintail, which outnumbered any other species 2 to 1. In the northern part of the Laguna Madre he saw a raft of about 129,000 redheads, the largest concentration of this species reported at any time during the season.

From this work it likewise appears that the principal wintering ground for the Central flyway is along the east coast of Mexico. Discovery of the great importance of wintering grounds in Mexico to the Central and Pacific flyways emphasizes the importance of conservation cooperation with that country.

INVESTIGATIONS IN THE UNITED STATES

The spring and fall migrations of the calendar year 1937 and the spring migration of 1938 were fully reported upon by a corps of carefully selected volunteer cooperators, who now number 522. These represent every State except Alabama and West Virginia, and their reports serve as a valuable supplement to the investigations of the official personnel.

During the winter of 1937–38 the biologists of the Mississippi and Atlantic flyways studied the concentration areas of the lower Mississippi Valley and the South Atlantic coast. All the evidence obtained indicated a substantial increase in the ducks and geese of these two flyways; in fact, the result of all investigations showed conditions in these flyways to be much better than in the Central and Pacific regions.

During the migration, nesting, and winter seasons reports were received regularly from officials in charge of Federal refuges, and these were carefully analyzed and collated with other reports.

The January inventory is the culmination of the Biological Survey's efforts to ascertain the numerical status of North American ducks, geese, and swans. Each year since 1934, when this investigation was inaugurated, the territory covered has been enlarged, but the coverage of all waterfowl wintering grounds is still far from complete. Inaccessible habitat and difficult terrain naturally make the survey less complete in some areas than in others, but the results, which are used for comparative purposes, have fully justified the efforts and funds expended.

The entire field personnel of the Bureau under nine regional directors participated, and this force was augmented by officers of the Forest Service, Soil Conservation Service, National Park Service, Naval Air Service, and the Coast Guard, and by cooperating State and county game and police officers, municipal officers, State forestry officers, assistants from State universities and colleges, superintendents and caretakers of gun clubs, and others. The Survey's fleet of patrol boats was reinforced by similar craft belonging to the State game departments, the Coast Guard, and other agencies. Special emphasis was again placed upon aerial coverage, and available aircraft included seaplanes, amphibians, autogiros, and dirigibles supplied by the Naval Air Service, the Coast Guard, a commercial tire and rubber company, and private citizens. Practically all areas along the Atlantic and Gulf coasts were surveyed from the air, some sections being covered by two or more observers as well as being checked by land or water. While exact figures are not available, it is believed that the total personnel participating exceeded 2,000.

As a result of this Nation-wide survey, and considering the numbers of ducks and geese known to be wintering in Alaska, Canada, Mexico, the West Indies, and other areas outside the United States, as well as those in parts of this country that could not be completely covered or were not covered at all, it is estimated that the continental waterfowl population is still less than 50,000,000. This year's statement on the waterfowl situation was contained in a leaflet (BS–111, mimeographed) issued in April. These annual statements have proved most useful in demonstrating to sportsmen and conservationists that the Biological Survey has essential data as a basis for prescribing regulations for taking ducks and geese.

BANDING GAME AND OTHER BIRDS

COOPERATORS

Physical limitations in handling the great mass of detailed bird-banding records, which must be maintained with a high degree of accuracy, make it necessary to decline many offers of cooperation. There has, however, been a slight increase in the number of stations—2,193 as against 2,129 a year ago. Of these, 110 are devoted to banding migratory waterfowl, 30 being located on Federal refuges. During the year a number of stations have each reported the banding of more than 5,000 birds. The cooperator heading the list banded 27,076, most of which were migratory waterfowl. Next on the list are two Survey men, one of whom banded 16,551 birds, and the other 7,436, most of which were tricolored redwings.

NEW BIRDS BANDED

The grand total of new birds banded and reported during the year is 346,056, an increase of more than 45,000 over the previous year. The number of bands purchased during the year was 565,000.

The birds banded represent 431 species, of which 16 are species (a few not native to the North American Continent) on which Biological Survey bands had never before been placed, as follows: Noddy tern, Laysan albatross, Pacific fulmar, wedge-tailed shearwater, Bulwer's petrel, blue-faced booby, Egyptian goose, masked bobwhite, white-crowned pigeon, ringed turtle dove, Harris's hawk, Sennett's white-tailed hawk, smooth-billed ani, golden-fronted woodpecker, black-whiskered vireo, and Lucy's warbler. This is a rather remarkable record, considering that such a large proportion of North American species have already been marked with bands.

The list of banded birds is again headed by the chimney swift, with 25,607, followed by the herring gull, with 18,805; the white-throated sparrow, 17,026; the pintail, 16,360; the junco, 14,701; and the mallard, with 13,587. More than 5,000 mourning doves were banded, and among the more unusual species of waterfowl marked were 280 blue geese and 9 immature black brant. These last were banded in the Mackenzie delta by the Mississippi flyway biologist, who also obtained excellent motion pictures of the operation, this probably being the first time that young black brant have ever been so photographed. The numbers of the different species of waterfowl banded during the fiscal years 1937 and 1938 are shown in table 1.

TABLE 1.—*Waterfowl banded during the fiscal years 1937 and 1938*

Species	1937	1938	Species	1937	1938
	Number	*Number*		*Number*	*Number*
American merganser	7	6	Greater scaup	66	165
Red-breasted merganser	10	15	Lesser scaup:		
Hooded merganser	7	9	Wild	919	5,295
Mallard:			Hand-reared	50	
Wild	14,319	11,519	Ring-necked duck	951	2,057
Hand-reared	1,434	2,068	Goldeneye	3	3
Black, cross		3	Bufflehead	43	29
Black duck:			Old squaw		7
Wild	3,613	6,319	American eider		4
Hand-reared	1,279	1,029	Pacific eider	2	
Florida duck	44	159	American scoter		2
Gadwall	[1] 738	694	White-winged scoter		4
European wigeon		5	Surf scoter		1
Baldpate	1,426	1,379	Ruddy duck	36	83
Green-winged teal	4,803	8,372	Snow goose	9	34
Blue-winged teal	4,740	5,353	Blue goose	96	280
Cinnamon teal	183	420	Ross's goose		3
Shoveler	349	495	White-fronted goose	1	39
Pintail:			Canada goose:		
Wild	11,248	16,060	Wild	386	458
Hand-reared	519	300	Hand-reared		15
Wood duck:			Black brant		9
Wild	458	405	Egyptian goose		1
Hand-reared	430	188	Fulvous tree-duck	[1] 7	15
Redhead:			Whistling swan		5
Wild	817	2,083			
Hand-reared	110	100	Total	49,329	66,235
Canvasback:					
Wild	185	644			
Hand-reared	41	96			

[1] Correction of figures printed in report for 1937.

RETURNS AND RECOVERIES

During the year there were reported 22,950 banded birds recovered either at the station where they were banded or elsewhere. This is an increase of about 5,000 over the previous year. Neither these record cards nor those received during the fiscal year 1937, in all, about 40,000, have yet been coded, punched, and distributed in the files, but it is planned to have this work done early in the ensuing year under a W. P. A. project.

The reports have included many of unusual interest either involving a new locality for a species or representing an unusual migration. At the close of the year an analysis was in progress of the migratory-waterfowl records received and punched since like data were analyzed in 1934. As these include data received during drought years, it is anticipated that interesting deductions will be possible as to the eastward and westward trends of waterfowl from the Central flyway.

For the first time, so far as known, colored bands were used this year on a large scale in studying bird migration, 5,000 herring gulls having been marked with brightly colored bands of red, blue, yellow, or black, supplied by the Survey to the Linnaean Society of New York, the National Association of Audubon Societies, and the Northeastern Bird Banding Association, in furthering a cooperative study. Young birds not yet able to fly were banded at 10 key stations along the Atlantic coast from Labrador to New York, each station having its own color combination. Protected under the Migratory Bird Treaty Act, herring gulls have greatly increased in numbers. Those that breed commonly along the coast from New England to Labrador winter farther south, to the Gulf of Mexico. Information on their fall and winter distribution, however, is rather limited and data obtained in recent years have been based largely on gulls marked with the Survey's aluminum bands. This information has been slow to accumulate because in most cases the recovery of bands had to await the death or injury of the gulls. Use of colored bands in obtaining "sight recoveries" is expected to speed up tracing the first-season movements of birds. During the year approximately 180 of these "sight returns" were reported from the vicinity of New York harbor.

One number of Bird Banding Notes was mimeographed in December and included the annual summary of banding work and other items useful to operators of banding stations.

RECORDS OF BIRD DISTRIBUTION

Data pertaining to the distribution and migration of birds continue to be added to the files. This year, these included 51,000 data cards, more than 1,700 locality cards, and 1,000 bibliography cards.

The number of migration observers is now 403. While it is not desirable indefinitely to increase their number, a few cooperators desirably located and able to contribute worth-while information have been added. A summary of their reports on the spring migration of 1937 was issued as Bird Migration Memorandum No. 3.

During the year distribution maps have been remade of four families—the cuckoos, kingfishers, woodpeckers, and parrots. The maps for the woodpeckers serve as a basis for the distribution and migration sections in a report on this family prepared for publication by the United States National Museum in its series of bulletins on Life Histories of North American Birds.

The series of maps showing the original and present breeding ranges of important game birds as well of game and fur mammals is now being corrected with a view to publication.

STUDIES OF WILDLIFE IN RELATION TO FORESTS AND RANGES

Studies of the animal factor in relation to pine reproduction at the California Forest and Range Experiment Station, at Berkeley, showed that the possibilities of success are best when reseeding closely follows a burn, a time when the rodent populations are at a low ebb. Experiments demonstrated that hastening germination by stratification may be of value in shortening the time the seeds are exposed to field mice and birds. Damage by rabbits to pine plantations continued to be a serious problem in northern California brush fields. Spraying nursery seedlings with strychnine-resylchloroform was somewhat successful in reducing clipping damage. Research on rodents of the range, including predation in relation to abundance, census methods, and the effects on range production, composition, and density, has been undertaken at the San Joaquin Experimental Range. In cooperation with the Forest Service, the study of predator-prey relationships on the Los Padres National Forest, Calif., yielded data also on wildlife populations and daily activities. The year's results on cooperative valley quail management have been prepared for publication by the State of California.

At the Pacific Northwest Forest Experiment Station, Portland, Oreg., studies of forest regeneration indicated that the present practice of slash burning following logging in the Douglas fir region, unless done lightly, removes sufficient seeds and second growth to restrict reproduction of the desired trees and that the success of subsequent planting or seeding is thwarted largely by rodents. On the other hand, intermittent second growth favors deer, grouse, and other game species, which react favorably to the openings created. Range studies in eastern Oregon on fenced plots from which pocket gophers were removed showed a gradual return to original forage conditions. Moderate grazing removed considerable surface vegetation, thus discouraging meadow mice, which destroy the crowns and roots of forage plants.

Research on white-tailed deer at the Lake States Forest Experiment Station, St. Paul, Minn., proved that the carrying capacity of winter ranges is rapidly declining and that the browse species now available do not have maximum nutritive value. Through overabundance locally, deer severely damage pine reproduction. Studies of beaver foraging yielded data showing that about 64 percent of the total food available in cut aspens was wasted. Tables have been prepared for publication that will enable wildlife managers, foresters, and others to estimate the quantity of food that can be expected from given stands of aspen available to beavers. In the same region work has been begun on the animal factor in coniferous reproduction, on management of sharp-tailed and pinnated grouse in the sand dunes of North Dakota, and on the value of coniferous cover plantings in burned areas to assist in breaking up heavy winter concentrations of deer.

At the Northeast Forest Experiment Station, New Haven, Conn., a detailed study of the values of native trees in wildlife management has been completed. A preliminary report on identification of animal damage to forest trees has been prepared as a practical aid to foresters. Observations on the Pillsbury State Reservation, N. H., show the use made by wildlife of artificial forest openings, food plantings, and specially manipulated cover.

Research at the Harrison branch, Southern Forest Experiment Station, near Gulfport, Miss., revealed a great consumption of the mast of longleaf pine in good seed years, and little damage in off years. Experiments are now under way to determine how much artificial seeding can be done without attracting undue numbers of birds. Before practical use can be made of this information, the best season for planting must be determined as well as means of hastening germination, so as to lessen the time of seed exposure.

Through cooperation with the Forest Service, experienced biologists, who have assisted in correlating forest-development programs with wildlife requirements, have visited national forests in the Lake States, Northeast, Appalachian, Southeast, Gulf States, and Mississippi Valley regions. This has resulted in better balanced programs, especially those proposed where silvicultural practices, road and recreational development, grazing, and other forest uses might have interfered with the desirable wildlife populations.

In the Rocky Mountain and Pacific Northwest regions field work has dealt with the ecology of fur animals, development of satisfactory wildlife-census methods in forest areas, determining breeding and feeding habits, and working out territorial requirements and yield data as important considerations in the management of fur species.

BIOLOGICAL INVESTIGATIONS ON WILDLIFE REFUGES

A complete grazing survey was made of big-game animals and long-horned cattle on the Wichita Mountains Wildlife Refuge, Okla., and the results will be used as a guide in regulating their numbers and distribution. Studies on wild turkey nesting showed that about 38 percent of the nests were successful. Two resident research men have been assigned to this refuge, and an extensive program is under way, including big-game range studies, preparation of a cover-type map, and collection of birds, mammals, reptiles, insects, and plants for laboratory study. Specific problems being investigated include life histories of wild turkeys, quails, prairie chickens, fox squirrels, and rabbits, predator relationships, and the biology of reptiles. A general wildlife survey also is being made of the refuge.

Development of the Patuxent Research Refuge, Md., has included the construction of a laboratory and a stock barn, remodeling of Snowden Hall as a headquarters building, repair of an old residence, and completion of the Cash Creek Dam. Since December 1937, 200 W. P. A. laborers and a C. C. C. side camp have greatly aided the development program. Little research will be undertaken until the construction work is completed.

At the Bear River Refuge, Utah, data were assembled for publication on an intensive waterfowl nesting study, work was completed on the development of census methods for adult and nesting waterfowl, and much information recorded on waterfowl sex ratios, on the life history of muskrats, and on migrations.

WILDLIFE-MANAGEMENT RESEARCH

COOPERATIVE RESEARCH UNITS

To extend research in wildlife management, 2 new units were organized this year, one in Missouri, the other in Pennsylvania, bringing the total number of units working chiefly in cooperation with land-grant colleges, State game departments, and the American Wildlife Institute to 11 (tables 2 and 3). The results in 3 years have included the assembling of many data of practical application for game administrators. The program includes specialized training of advanced students in the wildlife field and provides for demonstrations of the best management practices.

TABLE 2.—*Wildlife research and demonstration units cooperating with the Biological Survey, the areas involved, and the animal life studied*

Research units and headquarters	Trial demonstration areas		Areas involved in research		Major game species studied
	Number	Size	Size	Area in private lands	
		Acres	*Acres*	*Percent*	
Alabama (Polytechnic Institute, Auburn)	2	1,500	75,000	100	Mourning dove, deer, turkey, quail.
Connecticut (State College, Storrs)	2	6,200	6,200	90	Rabbit, pheasant, grouse.
Iowa (State College of Agriculture and Mechanic Arts, Ames)	2	11,460	19,960	100	Pheasant, quail, waterfowl.
Maine (State University, Orono)	2	6,400	27,480	20	Woodcock, grouse, beaver, deer, moose, waterfowl.
Missouri (State University, Columbia)	4	24,785	112,815	51	Deer, rabbit, wild turkey, quail, chukar partridge.
Ohio (State University, Columbus)	4	12,100	51,000	18	Deer, pheasant, waterfowl, squirrel, rabbit, raccoon.
Oregon (State Agricultural College, Corvallis)	2	20,000	1,820,000	10	Antelope, deer, grouse, pheasant, beaver.
Pennsylvania (State College, State College)	3	6,620	6,620	10	Deer, bear, pheasant, wild turkey.
Texas (Agricultural and Mechanical College, College Station)	15	100.000	2,921,760	95	Quail, wild turkey, prairie chicken, squirrel, deer.
Utah (State Agricultural College, Logan)	2	115,500	732,000	25	Deer, beaver, sage and sharp-tailed grouse, waterfowl.
Virginia (Polytechnic Institute, Blacksburg)	4	51,000	51,000	14	Quail, wild turkey, deer, grouse.
Total	42	355,565	5,823,835		

TABLE 3.—*Personnel engaged in research, demonstration, and training in cooperation between the Bureau of Biological Survey, land-grant colleges, State game commissions, and the American Wildlife Institute*

Research unit	Whole- or part-time workers	Graduate students	Students receiving advanced degrees, 1938	Enrolled undergraduates in wildlife management	Projects under way	Phases of research projects completed, 1938
	Number	*Number*	*Number*	*Number*	*Number*	*Number*
Alabama	10	4	1	0	7	2
Connecticut	6	2	1	14	4	3
Iowa	14	7	0	10	12	1
Maine	18	6	3	19	11	3
Missouri[1]	18	4	0	25	10	0
Ohio	25	5	3	35	9	3
Oregon[1]	25	4	2	157	11	2
Pennsylvania[1]	6	0	0	0	8	0
Texas	14	5	2	69	6	2
Utah[1]	14	4	1	53	7	1
Virginia[1]	16	7	2	50	14	4
Total	166	48	15	432	99	21

[1] Additional cooperation with the Forest Service.

A summary statement was mimeographed during the year (Leaflet BS–98), entitled "Colleges and Universities Offering Courses in Wildlife Management, 1937–38," with a list of all graduate and undergraduate wildlife courses offered by one or more colleges for preparing students for research, administration, and management. "The Status of Wildlife Research: 1937" was the title of another leaflet (BS–104) in the series, issued in February. To aid cooperators and others who are planning for wildlife management, an outline leaflet on this subject (BS–107) was issued in March.

Life history and management of the mourning dove continued to be the major project of the Alabama research unit. Records of the movements of some 1,800 banded birds and of the food contained in 1,083 stomachs have greatly augmented information valuable for the management of the species as regards breeding, nesting, growth, food habits, and migrations. Two reports of progress have been completed. In seven farming localities in the State, 510 experimental quail-food plots were planted, and data from these have been assembled on preferable planting dates, time of seed ripening, diseases and pests, rate of yield, time of shattering, and length of time that seed was available. More than 1,900 quail stomachs were collected for analysis. The importance of native deer foods was determined seasonally by examination of 194 stomachs and by observations on feeding and studies of browse plants. The relationship of foxes to quail was investigated by a study of the food in 70 fox stomachs and observations on the debris around 26 dens, with no indication so far that the fox is harmful to quail. A waterfowl food survey was made in the 5,000-acre Gulf Shores State Park.

The principal project at the Connecticut research unit was the life history and management of the cottontail rabbit. Home and seasonal ranges, growth, and food and cover preferences were subjects of research. Examination of more than 400 rabbits revealed the occurrence of two subspecies. The statistical study was completed as a basis for predicting population trends.

The major accomplishment at the Iowa research unit was the development of census methods for ring-necked pheasants and quail. A report on the ecology and management of the blue-winged teal was published in book form by the State. Progress has been made on studies of quail and pheasant management, nesting of diving ducks, management of muskrats, skunks, rabbits, raccoons, and mourning doves, and on mortality factors.

At the Maine research unit, through stomach examination of 59 woodcocks, it was found that earthworms comprised 87.4 percent of the diet. Of 143 birds dissected, 63 harbored endoparasites. Eighteen nests were located and 78 young banded. About two-thirds of the artificial singing grounds were used. Experiments with beavers in pens resulted in loss of weight and finally death from malnutrition, even though the animals were given plenty of natural foods. Research on Anasagunticook Lake was completed and definite plans for wildlife management recommended. Ten moose were examined for evidences of disease.

While work at the Missouri research unit began only this year, definite progress was made in studies on the chukar partridge, wild turkey, and quail, and on rabbit and deer management.

An intensive survey of pheasant management areas in northern Ohio has been nearly completed as part of the cooperative program of the Ohio research unit. The study has disclosed reasons for the high production of pheasants locally and for the success of the farmer-sportsmen associations. A report on investigations of parasites of gray and fox squirrels has been submitted. On Pymatuning Lake 357 waterfowl were banded to get information needed for managing the area. Management studies continue on fox and gray squirrels, deer, and raccoons.

At the Oregon research unit completion of a study of big-game sex and increase ratios revealed only slight unbalance in the huntable species. Possible beaver restocking areas of the State were mapped. A manuscript was prepared on investigations of small-game problems in the Willamette Valley. The antelope survey resulted in the game commission declaring a limited open season. Close observations on the 3,000-acre management area near Dallas showed upland bird population increases due to the changing of farm-crop rotations. As the results of field studies, recommendations were made for the reduction of deer herds in critical areas, regardless of sex, and for the provision of better areas for upland bird encouragement.

Due to findings of the Texas research unit, the season on Attwater's prairie chicken has been closed and steps taken to encourage natural increase. The outlook is also favorable for better quail management in Texas as a result of facts developed by research. Conditions necessary for gray and fox squirrel conservation have been determined. Five counties are involved in wildlife-research projects, almost 3,000,000 acres have been surveyed, and the work in Walker County has been completed. The major factors hindering quail production that are subject to control by man were found to be heavy hunting, overgrazing and undergrazing, maintenance of climax stands of pine, and early cropping practices that damage winter range. Through development of a satisfactory census method, Attwater's prairie chicken was estimated to include about 8,700 birds in Texas, occupying nearly 10 percent of the former range. A bulletin is being prepared

on prairie chicken management, recommending a 5-year close season as adopted recently by the State Game, Fish, and Oyster Commission. Progress has been made on studying wildlife-vegetative relationships.

At the Utah research unit particular attention has been given to problems confronting the State Game Department. Projects relate to the mule deer, sage grouse, sharp-tailed grouse, beavers, waterfowl-food resources, and wildlife diseases. Part of the sage grouse life-history and management study has been completed, but research on the effects of sheep on nesting mortality is still in progress. The beaver's role in soil and water conservation and the controversial beaver-trout relationship are being studied. Experimental work on deer-census methods, rate of increase, food preferences, conflicts in livestock-deer relationships, sex ratios, winter losses, migrations, and hunting removal has yielded considerable data for the management of this important game species.

The principal project at the Virginia research unit is the life history and management of the eastern wild turkey. Practical rearing technique has been worked out, and quantity production has been undertaken by the Virginia Commission of Game and Inland Fisheries. A wildlife-management plan has been completed for the Mountain Lakes demonstration area. Winter food habits of bobwhite quail have been determined through the examination of 559 stomachs. Food habits at other seasons are being learned from analysis of 249 other stomachs. Fifty-two wild turkeys were liberated on the North River demonstration area, George Washington National Forest, where studies to determine their wildness and survival are under way. Eighty-six deer were stocked in western Virginia counties and their progress studied. On the Blacksburg quail-demonstration area 55 food patches were established and their availability and utilization determined. Mass plantings were made of cover plants and shrubs adapted to pastures and wood lots. Progress was made on a survey of native plants of the State to determine potential wildlife food and cover resources. Studies are being continued on beavers, methods of crow control, and development of a nonpoisonous lead-alloy shot.

WILDLIFE EXTENSION WORK

In cooperation with the extension services of the various States, and as part of the cooperative research units' program, wildlife extension work was carried on in a number of States. This was summarized in a mimeographed leaflet (BS–106), Report on Extension Work in Wildlife Conservation to December 1937, issued by the Survey in March. Activities included the organization of game-management areas in farming districts, as in Texas, where 4,400 individuals banded together to establish 262 management areas, comprising 4,709,000 acres, on which 110 management associations were formed. In Texas, 138 counties have placed wildlife management in their extension programs for 1939.

In Iowa the wildlife program included holding 20 training camps for 4–H Club members and giving 25 radio talks, lectures, and demonstrations.

At the various research units attention was given to preparing publications of use to persons desiring to cooperate in wildlife conservation. 4–H Club conservation schools were held in several States. Radio programs, press releases, bulletins, and talks before farmers' organizations and civic groups were given in various States, supplementing the work done from the Washington office. The Biological Survey cooperated with the Extension Service in issuing a Miscellaneous Publication (No. 291) in March entitled "Teaching Conservation of Wildlife through 4–H Clubs." A leaflet (BS–108) entitled "History and Significance of American Wildlife" was issued for educational purposes, chiefly for use in schools.

WILDLIFE AS A SOURCE OF FARM INCOME

Investigations begun in May 1936, in cooperation with the Bureau of Agricultural Economics, on wildlife as a source of supplemental income on farm lands, were completed June 30. Through conferences and with the assistance of agricultural experiment station directors, farm-management specialists, county agents, foresters, and members of State conservation departments and planning boards, a good picture of prevailing conditions was obtained in all the States.

Following the reconnaissance survey last year, detailed studies were made of existing game-management areas on farms in Ohio, Iowa, Michigan, and Texas.

The results indicate that such areas, exceedingly variable in organization and administration, have been established on farm lands with varying degrees of success and that success depends largely upon the circumstances and personal interests under which they were instituted and operated. A report is being prepared for publication on the economics and social returns from farm wildlife.

STATE BIOLOGICAL SURVEYS AND FAUNAL REPORTS

Field studies on the mammals of Arizona and Florida have been completed, and reports on them are in preparation for issuance in the North American Fauna series. An extensive monograph was published as No. 56 of this series under the title "Revision of the North American Ground Squirrels, with a Classification of the North American Sciuridae." Work has progressed on the classification of the red squirrels (*Tamiasciurus*) and should be ready for publication in another year. A cooperative publication on the birds of Louisiana is now in press. Material on the birds of Texas will be assembled for a two-volume book for cooperative publication early next year. The work on the birds of Georgia requires about 2 months more of field work for completion.

REFERENCE COLLECTIONS AND RECORDS

The Bureau's reference collection of birds, mammals, and other vertebrates has been used as a basis for reports on classification, life histories, habits, and distribution. During the year, 1,232 mammal specimens were added to the collection, 553 were identified for 34 institutions and individuals in 26 States and 1 foreign country, and 261 were borrowed for study from 8 institutions, and 685 bird specimens were added to the collection, 1,735 were borrowed from 66 institutions, representing 29 States and Canada, and 392 were lent to 15 institutions in 15 States.

Scientists of the Bureau described 1 new bird of the genus *Penthestes;* 21 new mammals in the genera *Citellus, Cratogeomys, Dipodomys, Eutamias, Heterogeomys, Neotoma, Nyctomys, Peromyscus,* and *Thomomys;* and 2 new subgenera, *Poliocitellus* and *Notocitellus.*

The total number of mammal type specimens is now 1,253; a manuscript will be prepared for the North American Fauna series giving a list of them. The Bureau's mammal laboratory was used by 65 research workers from 19 States and 3 foreign countries. The aid of W. P. A. projects expedited the work of cleaning, rearranging, and bringing the mammal collection to date and of detailed cataloging and assembling the data on birds.

ECONOMIC RESEARCH ON WILDLIFE

That the mere provision of refuges is not sufficient to guarantee the increase of wild-animal populations is evident from the fact that many of the sanctuary areas consist of unimproved marginal and submarginal lands. One of the most important research jobs of the Biological Survey, therefore, is to learn about plants that may be used to improve the refuges. These should produce the foods preferred by the animals to be encouraged, and the conditions necessary to their growth should be made known. Special studies are being conducted on foods of the ruffed grouse, prairie chicken, bobwhite, valley quail, ring-necked pheasant, wild turkey, band-tailed pigeon, mourning dove, gray squirrel, and white-tailed deer.

The provision of adequate food and cover may not in itself entirely suffice, inasmuch as the competitor and predator populations of game areas may fluctuate and variably affect the managed species. Consequently many areas throughout the country are being carefully appraised to determine the maximum carrying capacity and to discover the causes for population fluctuations and how they may be held to a minimum. Aid in meeting the situation may come from studies now being actively carried on of the feeding habits of snakes, fish-eating birds, hawks, owls, foxes, coyotes, bobcats, feral house cats, weasels, skunks, and other predators.

That winter losses in wildlife, especially game and song birds, can be lessened by prompt and regular feeding during periods of food scarcity was emphasized in Farmers' Bulletin No. 1783, Feeding Wildlife in Winter, published this year.

WATERFOWL-FOOD INVESTIGATIONS

EELGRASS SITUATION

In the 7-year period since eelgrass (*Zostera marina*), formerly the principal food of the American brant, was decimated by a wasting disease, sporadic improvements in the stands have been observed at many places along the Atlantic coast. New growths approaching former abundance have been established only in some of the large bays and estuaries where the water is less saline than the ocean, including Shinnecock Bay, Long Island, N. Y., and Chesapeake Bay, in Maryland and Virginia. Several flourishing beds of eelgrass have been observed also extending from the mouths of rivers upstream to reaches where the salinity is only a half to a third that of normal sea water. Though the eelgrass crop this year was substantially larger than for several years past, the brant are still affected by the subnormal abundance of this important food. Observations on its status in February 1938 and notes on experimental plantings were summarized in a leaflet (BS–110) issued during the year.

As noted in last year's report, wigeongrass (*Ruppia maritima*), an excellent waterfowl food, continues to invade the areas formerly dominated by eelgrass. In a study area where wigeongrass once made up not more than a fifth of the bulk of the plant growth, it now constitutes approximately 80 percent of the submerged vegetation.

Reports of the decline of eelgrass on the Pacific coast were investigated. The findings do not seem, however, to substantiate claims that the grass has been affected. Every indication points to a normal crop of the plant in Pacific coast waters.

TRANSPLANTING AND PROPAGATING DUCK-FOOD PLANTS

The contents of 8,000 stomachs of game ducks, studied over a period of many years by past and present workers of the Bureau, were tabulated to serve as a basis for recommending propagation of the chief regional duck foods for each species. In a forthcoming bulletin (Technical Bulletin No. 634) entitled "Food of Game Ducks in the United States and Canada," which will be of interest to technicians concerned with the improvement of marsh and aquatic areas for waterfowl, each of the foods tabulated is described with respect to its abundance, habitat, propagation, and utilization. Most of them also are illustrated and their distribution mapped.

Several attempts to transplant healthy Atlantic coast eelgrass have been entirely unsuccessful, as have been repeated introductions of the unaffected Pacific coast form.

Plantings of eelgrass and wildcelery (*Vallisneria spiralis*) on the Bear River Migratory Bird Refuge, Utah, have not made a permanent stand, but the results of the transplanting of local waterfowl foods to the dikes and borrow pits have been gratifying.

To facilitate studies on the experimental propagation of waterfowl-food plants a battery of 24 ponds was excavated on the Patuxent Research Refuge, Md. In four of these, the bottoms of which were covered with desiccated muck from a natural swamp on the refuge, spatterdocks (*Nymphaea*) and burreeds (*Sparganium*) germinated abundantly. Tuber and rootstock material of three kinds of bulrushes (*Scirpus acutus, S. americanus*, and *S. robustus*), claspingleaf pondweed (*Potamogeton perfoliatus*), sago pondweed (*P. pectinatus*), wildcelery, marsh smartweed (*Polygonum muhlenbergii*), and arrowhead (*Sagittaria* sp.) also were transplanted and grown successfully.

To aid the work of three field stations newly established for experimental propagation of waterfowl foods, bibliographic research on the reproduction and growth of marsh and aquatic plants has been continued. At the same time intensive taxonomic studies of these food plants have been made to provide a basis for sound field observation.

Seeds of waterfowl-food plants not previously investigated were added to those of some 40 species stored in the fall of 1936, and samples of each were carried over winter in three ways: (1) Immersed in water at approximately 36° F.; (2) dry at approximately 36°; and (3) dry at room temperature. Sample seeds also were immersed in water at room temperature immediately after collection to ascertain whether they would germinate without undergoing after-ripening.

In the spring, germination tests were run with 41 species of waterfowl-food plants, including 9 pondweeds and 8 bulrushes. Germination experiments begun

in 1937 were continued to determine the longevity and viability of seed kept continuously in water at growing temperatures.

These experiments have confirmed the conclusion that cold storage in water is the most satisfactory method of handling seeds of most aquatic plants. Additional methods of storage and treatment will be investigated, since the results also indicate that a considerable number of species require special handling if the highest percentage of germination is to be obtained. It was further noted that a few species, including the dotted smartweed (*Polygonum punctatum*), pondweed (*Potamogeton panormitanus*), and wildrice (*Zizania aquatica*), will germinate after 4 or 5 months in dark cold storage, in water not colder than 36° F.

A number of plants have come to attention this year as being of special value locally as food for shoal-water ducks and geese in various sections of the country. In Louisiana, both seeds and tubers of the squarestem spikerush (*Eleocharis quadrangulata*) have proved to be important in the diet of ducks wintering in the Delta section as also is a slightly smaller form, the Gulf-coast spikerush (*E. cellulosa*). In the Bear River marshes, Utah, and at Malheur Lake, Oreg., Canada geese have been found to feed extensively on seedling squirreltail grass (*Hordeum jubatum*) in preference to other more abundant foods. An economic service is thus performed, as this grass is a troublesome weed and a predisposing cause of necrotic stomatitis in livestock and elk. Further study of stomach contents, coupled with field observation, indicates that sawgrass (*Cladium jamaicense*) is of considerable value to ducks as a regular dietary supplement.

FOOD RESOURCES OF WILDLIFE REFUGES

The food resources and general biological suitability of proposed migratory-waterfowl refuges in Maine, New Jersey, Maryland, Kentucky, Tennessee, Mississippi, Louisiana, Arkansas, Texas, and Colorado were investigated. Planting programs looking to improvement in food and cover conditions were suggested for some of these areas and for several existing wildlife refuges in Maine, New Jersey, Maryland, North Carolina, Tennessee, Louisiana, and Oregon; for sanctuary areas under the direction of the Forest Service in Virginia, of the Farm Security Administration in Maryland, of the Tennessee Valley Authority in Tennessee; as well as for the States of New York and Alabama and for the Muskingum Watershed Conservancy District in Ohio.

ECOLOGY OF WATERFOWL-FOOD PLANTS

Routine measurements of chemical and physical variations in the waters of duck-feeding grounds in the Southeast have been continued. The locks in the Chesapeake and Albemarle Canal, at Great Bridge, Va., formerly held open too much, have been normally operated for nearly 2 years, with a marked improvement in the aquatic flora of Currituck Sound, especially in the southern part, though the abundance of the plant life of the upper sound and of Back Bay nearer the mouth of the canal is still below normal. A marked increase in the duck population wintering in this area can be ascribed, in part at least, to this betterment of food conditions.

Work on the physicochemical optima for the growth of aquatic plants has been considerably advanced at the Delta Migratory Waterfowl Refuge, La., where extensive salinity tests, water-table determinations, and mechanical analyses of soils have been made.

SUPPRESSING OBJECTIONABLE MARSH AND AQUATIC VEGETATION

Alligatorweed (*Alternanthera philoxeroides*), an introduced species that tends to choke up waterways in subtropical areas, has continued to be a serious problem on the Delta Migratory Waterfowl Refuge. In a survey of natural enemies of the plant with regard to their possible usefulness in its control, several fungi were found, but none was pathogenic. A fungus (*Sphaceloma* sp.) that severely attacks the plant in South America is now being investigated cooperatively with the Bureau of Plant Industry under laboratory conditions. Another method of biological control tested was the making of numerous plantings of a wild millet (*Echinochloa polystachya*), which is an effective competitor of the alligatorweed in waterways on the refuge.

MOSQUITO CONTROL IN WILDLIFE HABITAT

In many States (Rhode Island, Massachusetts, Connecticut, New Jersey, Delaware, Maryland, Georgia, Tennessee, Michigan, and California) marsh areas have been surveyed to determine the effects of mosquito-control ditching on wildlife and on its habitat and food resources, in order to encourage the use of control measures least injurious to marsh-inhabiting species. When drainage has been undertaken without competent guidance and advice from entomologists and biologists, much of it has been unnecessarily destructive to game and fur mammals and birds and to their natural foods. Under adequate supervision the results have been far less detrimental. Cooperation with interested agencies has been furthered in attempts to have control operations proceed as far as reasonably possible along lines that have regard for conservation principles, so as to assure the fullest possible protection to wildlife, and thus serve the greatest public good.

Injury to wildlife habitats has been caused chiefly by altering natural water levels beyond the limits that most of the desirable plant and animal forms can tolerate and by lowering the level of water in ponds, thus destroying valuable submerged plants by subjecting them to injurious exposure or desiccation. In many instances altering the water levels has eliminated indigenous plant and animal forms and caused invasions of species that rapidly displace the food plants of waterfowl and other marsh denizens. An example will illustrate how ditching reduces the natural animal population of a marsh: Two areas, separated only by a small stream, and comparable as to plant and animal associations, elevation with respect to tide range and level, soil conditions, and location, were selected for study. One was ditched for mosquito control according to the usual methods, and the other was left undisturbed. A series of animal counts on plots 6 feet square on each was made throughout the year. Considering the unditched area as normal, the following reductions were revealed: After one season, in the saltmarsh cordgrass (*Spartina alterniflora*) association the reduction in invertebrate animals, primarily mollusks and crustaceans, was 43.5 percent; in saltmarsh bulrush (*Scirpus robustus*), 92.6 percent; in saltgrass (*Distichlis spicata*), 71.9 percent; and in saltmeadow cordgrass (*Spartina patens*), 84.2 percent.

Interested Federal and State agencies have cooperated with the Bureau in experiments concerned with studies of mosquito breeding in different types of marshes and of control measures not seriously injurious to the valuable fauna and flora. The results have led to recommendations that water levels be controlled where possible through the use of sluices, tide gates, and other means, and that mosquito breeding be checked by the use of killifishes, top minnows, and other predators of mosquito larvae. Similar cooperation has resulted in the preservation or partial restoration of considerable marshland valuable to wildlife. Amassing evidence that permanent ponds on saltmarshes rarely provide suitable breeding environment for mosquitoes, and as a rule need not be drained as a control measure, has resulted in saving for wildlife many marsh ponds along the North Atlantic coast and in the restoration of others by W. P. A. and C. C. C. workers through the installation of dams in the drainage ditches. In some instances wildlife habitat has been improved in connection with mosquito-control operations through the construction of ponds and lakes that serve both as reservoirs of natural predators of mosquito larvae and as homes for important species of wildlife.

Cooperating with the W. P. A., the Bureau has reviewed many applications for mosquito-control projects and other drainage operations throughout the country, with the result that some that would have been unnecessarily detrimental to wildlife have been disapproved or the proposed plans so modified as not to threaten injury to wildlife. In many cases, to the satisfaction of all concerned, such modification has resulted in the construction of artificial habitat to compensate for the unavoidable destruction of adjacent natural wildlife environment by necessary drainage. Wherever practicable, biological methods of mosquito reduction that involve water control and impoundment rather than the destructive measures of mechanical drainage have been recommended and prosecuted in the interests of the Nation's wildlife resources.

LABORATORY RESEARCH IN FOOD HABITS

Two of the Bureau's cooperative wildlife-research units detailed six students for work in the Washington laboratory for periods aggregating 18 months. One

full-time employee also was added to the staff. One temporary employee was made available by the Department of Conservation of New York for 8 months for special food-habits investigations of foxes, great horned owls, and ruffed grouse collected in that State. Through allocation of W. P. A. funds, 12 clerical assistants were available for a 6-month period to aid in indexing and tabulating accumulated examinations of the ruffed grouse, bobwhite, valley quail, ring-necked pheasant, mourning dove, and other game and nongame species, thus making the information on food habits more available for reference.

A total of 7,484 unit examinations, including stomachs, droppings, pellets, and nest samples, were made, representing 222 species of amphibians, reptiles, mammals, and birds. Stomachs were examined of 3,531 birds of 176 species, 1,004 mammals of 26 species, 18 lizards of 1 species, and 416 snakes of 12 species, in addition to 911 pellets of birds of 3 species, 78 droppings of birds of 4 species, 4 nest-debris samples of birds of 2 species, and 1,522 droppings of mammals of 8 species. Compared with last year's record of 4,072 examinations, this represents marked progress in determining the food habits of economically important species. Seed and plant identifications were incidentally made for a number of research workers engaged in wildlife studies and to aid game technicians on various Bureau refuges.

REPTILE COLLECTIONS

Additional reptile material from the George Washington National Forest was received through the cooperation of the Forest Service. During the year, 431 food-containing digestive tracts of 12 species of snakes were examined, making a total of 689 from this area, including representation of several species of potential importance to game management. Among them are the common black snake, pilot black snake, timber rattlesnake, and common water snake, species that prey to some extent on the contents of game-bird nests, the young of game mammals, or, in the case of the water snake, on fishes. The investigation of the relationship of the cottonmouth moccasin (*Agkistrodon mokasen*) to waterfowl and fur animals on the Delta Migratory Waterfowl Refuge, La., has been similarly advanced. Collection of bull snakes was initiated on the Valentine and Crescent Lake Refuges, Nebr., to obtain information on their general food habits and especially to ascertain the extent to which the species robs waterfowl nests. The abundance of bull snakes, coupled with the high losses of duck nestings on these areas, indicated the need of the study. A leaflet, Facts About Snakes (BS–103), which is of great value in answering voluminous correspondence, was revised.

MAMMAL STOMACHS

The findings of a food-habits study of 164 coyotes that had lost a leg, in a trap or otherwise, were presented in a paper entitled "Food Habits of Pegleg Coyotes," at the annual meeting of the American Society of Mammalogists, showing that such animals are somewhat handicapped in obtaining food, and consequently, to the detriment of domestic stock production, their diet differs from normal to the extent that they tend to seek out the slow-moving animals as well as bait or even carrion.

As a part of a study to determine deer-food preferences and the effects of deer browsing on forest shrub and tree growth, analysis was made of the contents of 59 white-tailed deer stomachs collected on the Superior National Forest, Minn. The findings were summarized and presented as part of a paper delivered at the Third Annual North American Wildlife Conference in Baltimore.

In studying the contents of the stomachs of a series of 31 squirrels collected by the Texas cooperative research unit, it was found that identification of the foods was practically impossible without having available for reference plant material taken at the same time and place as the animal. Consequently a field reconnaissance was made of squirrel study areas in Texas to determine their principal plants and to collect samples.

FOOD OF BIRDS

The food of game birds continues to be of paramount interest, the need for accurate and detailed information on the subject having been increased by the great expansion in upland-game work throughout the country. The bobwhite was the subject of a special food-habits study by the cooperative wildlife-research units in Alabama and Virginia, States in which this species is the outstanding game bird. Two graduate student cooperators, assigned by these units

for temporary duty in the Washington laboratory, analyzed 456 quail stomachs from Virginia and 375 from Alabama. In the latter State special attention was paid to the soil province from which the bird was collected with a view to correlating the data obtained with soil types.

The food habits of the mourning dove continued to be investigated for a second year, and 751 stomachs were examined. A graduate research student from the Alabama unit increased knowledge of the dove foods of that State through analyses of 194 stomachs. A paper entitled "Some Important Foods of the Mourning Dove in the Southeast" was presented at the Third Annual North American Wildlife Conference.

Knowledge of food habits of prairie chickens was advanced through the joint efforts of the Bureau's Texas cooperative research unit and the Washington laboratory with a total of 24 unit examinations completed, including droppings and stomachs.

The movement to restore the wild turkey to a more important position as a game bird has continued, increasing interest being shown in efforts to improve its habitat on publicly owned lands. Studies to determine the prevalence of the choice foods utilized in the wild were continued, and 94 birds were examined. Of these, 26 were from the George Washington National Forest, 20 from other areas in Virginia, 3 from Alabama, and the remaining 45 from various sections of the United States. The Virginia research unit assigned a graduate student to the laboratory for 1 month to study some of the material collected in Virginia.

In cooperation with the Utah research unit, limited study involving 53 stomachs was made of the food habits of sage grouse.

In the course of the Bureau's economic studies of wildlife conducted during the past 53 years, stomachs of many extralimital species as well as of species now extinct or nearing extinction have been received. The results obtained from the study were reported at the 1937 meeting of the American Ornithologists' Union in a paper entitled "Food of Rare, Uncommon, and Extinct Species of North American Birds."

COOPERATIVE FOOD-HABITS RESEARCH

AID TO STATE AND OTHER AGENCIES

There were examined for the Michigan Department of Conservation 552 otter droppings and an aggregate of 35 droppings of bobcats, coyotes, foxes, minks, and skunks. The stomachs of 20 collared lizards were analyzed for the University of Michigan. Droppings of 816 foxes, pellets of 263 owls and of 2 hawks, and stomachs of 178 ruffed grouse were examined for the New York State Conservation Department.

For the Forest Service, stomachs of 89 bobcats, 14 cougars, and 1 gray fox were analyzed; for the National Park Service, 2 bobcats and 9 coyotes; and for the Soil Conservation Service, 74 mourning doves were analyzed and several seed and plant identifications made. Examinations and determinations were made for other organizations or individuals as follows: 342 horned owl pellets for the University of Wisconsin; 11 Mississippi kite stomachs for Cornell University; and 20 woodcock and 1 jacksnipe for a private research worker.

INVESTIGATIONS ON THE GEORGE WASHINGTON NATIONAL FOREST

A 2-year study of the early winter food habits of ruffed grouse on the George Washington National Forest was summarized and a report submitted for Department publication as a joint contribution of the Bureau of Biological Survey and the Forest Service. The investigation was continued into a third year to determine more completely the range of foods eaten and the variation in the use of important foods. Six additional black bear stomachs were studied, bringing the total to 22 for this species on this forest.

FIELD INVESTIGATIONS OF GAME BIRDS

MOURNING AND WHITE-WINGED DOVES

Repeated complaints that the open season on the mourning dove was too short and too early in the year led to detailing an observer to Mississippi for several weeks before, during, and after the dove season. His investigations demon-

strated that the open season in that State, as probably also in Tennessee, commences while a large number of birds are still nesting and before many of the immature doves have attained sufficient size or strength to be classed as huntable on a sporting basis. A similar investigation is now being made of the breeding period of the white-winged dove in Arizona. Much added information on the food of these birds has also been obtained.

BAND-TAILED PIGEONS

The study of the habits, distribution, and migration of the band-tailed pigeon in relation to agriculture was continued in Washington, Oregon, and California, and some 400 stomachs were obtained from hunters. It was observed that in northward migration these birds tended to follow the areas of newly planted fields of oats and peas, and that along the west coast flocks feeding extensively on wild berries changed to a diet of acorns following a protracted rainfall.

CANADA GEESE IN NORTH CAROLINA

The large numbers of geese concentrated at the Mattamuskeet Migratory Waterfowl Refuge, N. C., where insufficient grazing was available, foraged this year on the surrounding farm lands, with the result that there were numerous complaints of damage. Investigation traced much of the damage to the fact that farmers wishing to have the geese around during the open season had encouraged them during the 3 fall months, but objected to their continued presence when the crops began to grow in spring. In this district corn is planted early to avoid the destructive effect of a tassel pest, but this practice subjects it, along with oats, soybeans, and other truck crops, to attacks by the geese. It was found that satisfactory protection can be obtained at low cost by netting the fields with hard-twist cotton cords strung 50 feet apart and 8 or 9 feet above the ground.

WATERFOWL

Mortality studies of duck nestings were conducted at the Malheur Migratory Bird Refuge, Oreg., Bear River Migratory Bird Refuge, Utah, and Crescent Lake and Valentine Migratory Waterfowl Refuges, Nebr., to determine the factors that affect waterfowl adversely during the breeding period. At the Bear River marshes and on other refuges studies have shown that there is a direct correlation between the species and number of ducks breeding and the type and extent of nesting cover available. Consequently, it is possible by manipulation of cover planting to increase the breeding number of pairs of Canada geese, redheads, mallards, and other ducks that select various plant associations in which to nest. Such alteration of cover flora, however, would be pointless if there were insufficient feeding, molting, and brooding areas available. Some of the above studies have been reported in three papers published in The Journal of Wildlife Management. Large numbers of nests were kept under observation at these refuges, and details of the history of each recorded.

FIELD STUDIES OF INJURIOUS NONGAME SPECIES

WINTER CROW CONCENTRATIONS

The severe drought years 1934–35, succeeded by 2 dry years, were probably a factor in the shifting of large winter roosts of crows in a southwesterly direction across Oklahoma. Because of the many complaints received, an investigator was assigned to spend several months studying their distribution and behavior in the new areas. The investigation was made in cooperation with the Oklahoma Extension Service, which circulated and tabulated questionnaires for reporting information on crow damage to agriculture. After a preliminary survey, Grady County, in which six roosts harbored 97,000 to 190,000 birds each, was chosen for careful study. One accomplishment was the development of a formula for standardizing appraisals of crow damage to grain crops. It was found that where grain sorghums were seeded early, crow damage was negligible, but this practice will not be widely acceptable because of the poor forage value of early-seeded sorghums. Much of the crow damage to agricultural crops in Oklahoma is due to grain and cotton crops being grown at the same time, so that as soon as the grain has been cut and shocked, the farmers' attention is diverted to the cotton, and he leaves the grain shocks standing in the fields over

a protracted period, more or less exposed to crow attack. If the grain harvest could be advanced the damage would be much reduced. In some areas farmers have considerably decreased the loss to grain left in the fields by carefully roofing the larger shocks with smaller bundles, heads down. An interesting finding of this investigation was the indifference or opposition of many farmers to crow control in areas where wheat is the principal crop, since the crow is an effective enemy of a very destructive beetle pest (*Phyllophaga* sp.) of wheat.

EUROPEAN STARLINGS

The mild winter of 1937–38 in the East was not conducive to much progress in the work of starling control. Further effort was made, however, to perfect a flock trap, the large size of which had made it difficult to devise a suitable trigger for springing it. It is of interest that in the course of experimentation one bird afflicted with avian tuberculosis was trapped, for in England the starling has been convicted of spreading gapeworms and foot-and-mouth disease. Although scarcely recognized by the average person, a continued decrease of starling populations in metropolitan areas was noted.

FISH-EATING BIRDS

On Elephant Butte Lake, N. Mex., an artificial reservoir abundantly stocked with game fish by the State Fish and Game Commission, large rafts of American mergansers had long caused considerable concern for game-fish supply. In severe winters the mergansers concentrate in the lower end, where the fishes are more abundant. Examination of the stomachs of 124 birds, collected over the whole area, revealed that game fish formed 53.6 percent of the food, while in the stomachs of birds taken on the lower end they formed more than 80 percent.

An investigation of a great blue heron rookery near Lewiston, Mont., was made in connection with reports of damage to trout. An intensive study of the food habits of the birds over a 12-day period revealed no evidence to support the claims. The bulk of the food consumed by these birds was composed of nongame fishes and miscellaneous invertebrates.

A Bureau leaflet (BS–83) entitled "Birds in Relation to Fishes" continued to serve a useful purpose in supplying information on this much-discussed topic. In several instances the leaflet has been abstracted by feature writers, thus further disseminating the fundamental facts contained in it.

BLACKBIRDS AND RICE

Ever since rice was first introduced into the Gulf coast sections of Louisiana and Texas, blackbirds have been a source of loss to rice growers. A leaflet (BS–96) entitled "Blackbirds and the Rice Crop on the Gulf Coast" was issued in November, to present facts on the type of damage, protected status of blackbirds, their migrations, possibility of avoiding crop damage by the use of early maturing strains of rice, methods of crop protection, and other details.

CROP-DESTROYING BIRDS IN CALIFORNIA

Bird depredations in California continue to demand close attention, although there are variations from year to year in the extent of damage and in the kinds of birds causing it. Injury by sparrows, linnets, and blackbirds was considerably less than usual; horned larks made serious inroads on the sugar-beet crop as in the past; and crows, jays, and magpies attracted much attention by their depredations in almond orchards. The third part of a cooperative manual entitled "Procedure and Methods in Controlling Birds Injurious to Crops in California" was prepared for State publication. Banding injurious species, including the tricolored redwing and Gambel's sparrow, was continued to provide information as to their seasonal movements.

MAMMALS

Information obtained in previous years on the behavior of gray foxes in raiding dummy quail nests was summarized in an article published in July 1938 in The Journal of Wildlife Management. This contribution is intended to facilitate the study of quail-nest mortality in areas inhabited by foxes and is part

of a more comprehensive report now in preparation on the food habits and economic status of foxes in Virginia.

The report on an earlier study of the economic status of pocket mice (*Perognathus*) was issued under the title "Pocket Mice of Washington and Oregon in Relation to Agriculture" (Technical Bulletin No. 608).

RESEARCH IN FUR-ANIMAL CONSERVATION AND UTILIZATION

DEVELOPMENTS IN FUR PRODUCTION AND THE FUR TRADE

The past year has been exceedingly trying and difficult for both fur producers and fur tradesmen. High feed costs, low raw-fur prices, disease outbreaks, reciprocity agreements, tariffs, Social Security regulations, and strikes raised many disturbing problems earlier in the year. By June, however, there was a complete change. Strikes in the fur trade had ceased, the stock market showed an upward trend, raw-fur prices increased, manufacturers resumed work, and the outlook for fall and winter became much brighter.

INTERNATIONAL PHASES OF FOX-PELT PRODUCTION

The United States and Norway now lead all countries of the world in silver fox production. Reports on whelping from Norwegian fox farms indicate a production this year of about 350,000 pelts. Other foreign countries also have increased production to a greater or lesser degree. The crop of pelts in the United States will almost reach that of Norway.

With world production increasing, however, the average price received for fox pelts is decreasing. In the face of added competition fur farmers generally have been urged to give more serious attention to raising stock of better quality. For many years the Survey has been advising fox farmers that unless they improve the breeding stock they will experience considerable losses. That many fox farmers may even be compelled to retire from the business unless the average quality of their pelts is improved and the production cost is lessened is substantiated by questionnaires sent out by the Bureau in a Nation-wide survey of fur farming, and the replies show that many persons engaged in this industry have already discontinued operations through inability to produce at a profit.

PRODUCTION OF MINK PELTS

Mink breeders apparently have made better efforts to improve fur quality than have fox farmers, judging from the pelts offered in the raw fur markets. Mink raising is still on the increase and is continuing to be a popular phase of fur farming for beginners. The prospective production of ranch-raised mink pelts is about 150,000 in this country.

STATISTICS ON FUR PRODUCTION

The Bureau began the first attempt at a Nation-wide survey to assemble fur-farming statistics by sending questionnaires to individual fur farmers. State directors of extension, county agents, fur farmers, fur-trade organizations, feed companies, publishers, and others cooperated by furnishing approximately 12,000 names and addresses of known fur farmers. About 8,000 questionnaires have already been mailed, and more than 2,000 have been returned. The data will be assembled and tabulated with the assistance of W. P. A. workers, and while the results compiled will be made public, individual returns will be confidential.

COOPERATIVE INVESTIGATIONS

REPRODUCTION IN MINKS

A cooperative study of reproduction in minks, inaugurated by the Bureau and the Carnegie Institution of Washington and financed by Bankhead-Jones cooperative research funds, was undertaken at Johns Hopkins University, Baltimore, Md., through employment of a biologist and an adequate staff of assistants. Work was begun by collecting and studying a large number of adult male and female reproductive tracts. A small colony of minks was maintained in the laboratory to permit observations during the breeding season. To determine

the optimum period of breeding, daily vaginal smears were taken, and to check the ovarian conditions against these results, the females were operated on at various intervals. Further study is necessary before the cycle can be definitely understood. Vaginal smears taken after some observed matings revealed no live sperms. Studies in spermatogenesis indicate that some infertility is due to a testicular deficiency in which sperms do not mature.

Living eggs were recovered and studied and the relationship of ovulation to copulation and fertilization determined. Both gross and microscopic observations on changes in the ovary and uterus during pregnancy and pseudopregnancy have been recorded. Gestation periods were checked in several cases with considerable exactness by obtaining vaginal smears of sperm and then watching for the exact time of birth. Attempts to determine pregnancy by injecting urine into test animals gave negative results. Mink urine proved to be very toxic. Following experiments that involved removal of the gonads, great improvement in the fur was noted. The animals used are being kept to ascertain whether improvement is still apparent at pelting time.

BREEDING AND INHERITANCE IN FOXES

The breeding and sales records of a second large silver fox ranch were made available to Bureau representatives for a study of the relationship of the age of vixen and time of whelping to the prices received for pup pelts. Information is also being obtained on the inheritance of silvering in foxes. Department Circular 460, Silver Fox Pelt Prices as Affected by Time of Pelting, Sex, and Age, published during the year, was the result of an earlier study of prices realized from the sale of pelts produced by one of the largest fox farms in the United States.

STUDIES OF GUARD HAIRS AND UNDERFUR

Samples of guard hair and underfur obtained over a period of several years from individual foxes receiving different experimental rations are being measured by W. P. A. workers. Measurements are being recorded of the total length of the guard hair and of the white band, and also of the natural as well as the stretched length of the underfur. It is hoped that this information will be of value in determining the inheritance of silvering and the cause of possible changes in silvering that may be affected by age, feeding, and environmental and other factors. This study includes fur not only from adult foxes but also samples taken every 2 weeks from pups 4 weeks of age up to pelting time. The investigation will reveal the character and relative growth of the fur and furnish additional information regarding the fur produced by fox pups.

KARAKUL SHEEP PRODUCTION

For 7 years the Bureaus of Animal Industry and Biological Survey have been cooperating in Karakul sheep-raising studies, with special reference to fur production. The continued popularity of Persian lambskins for use in coats and in trimmings on cloth garments has accelerated Karakul sheep production in this country. All Karakul lambskins produced this past year at the Research Center, Beltsville, Md., were appraised by fur specialists of the Survey. The same skins were taken to the raw-fur market, where experienced handlers of this article classified and appraised them. Pelts from lambs representing the fifth generation from breeding purebred Karakul rams to Corriedale and Black-faced Highland ewes were considered by commercial fur dealers to be as valuable as many of the lamb pelts produced from purebred Karakuls.

BREEDING IN OTHER FUR ANIMALS

Toward the close of the year a supplemental project was approved for studying the reproductive cycle of the muskrat. Hundreds of muskrat ovaries and testes were collected on the Blackwater Migratory Bird Refuge, Md., for preliminary treatment, with a view to obtaining additional knowledge on reproduction in this important fur animal. Reproductive tracts of foxes, fishers, bobcats, mountain lions, beavers, and other fur animals were collected and preserved for future study, and at the close of the year a report was in press on the reproductive cycle of the coyote. Three papers, one technical and two semitechnical, were presented at special meetings by the Bureau representative conducting this

research. The Bureau's contribution to the 1937 Yearbook of Agriculture, The Breeding of Fur Animals, was reprinted as a separate (No. 1603) to supplement the correspondence on the subject.

INVESTIGATIONS ON DRESSING DUTIABLE ORIENTAL SKINS

Cooperating with the Treasury Department, a representative of this Bureau visited China to obtain information on methods employed in dressing dog, lamb, and kid skins. He appeared as an expert witness in proceedings before the Court of Customs and Patent Appeals, between the Federal Government and the fur importers. The question was whether the dog, lamb, and kid skins imported from China were dressed, partly dressed, or raw. Duties amounting to many millions of dollars are involved in these cases, which are still coming up for trial.

QUALITY OF TANNED SKINS

Cooperative work with the Bureau of Chemistry and Soils, to determine the influence of environmental factors on the quality of raw and tanned fur-animal skins, has been continued. Pelts taken from young and adult silver foxes fed experimental rations were supplied by the Survey for this study. In addition, a number of prairie dog skins collected by field representatives of the Bureau and guinea pig skins furnished by commercial breeders and the Bureau of Animal Industry were transferred to the Bureau of Chemistry and Soils for use in experimental tanning tests to determine their commercial value. Australian rabbit skins also were supplied.

FELTING STUDIES

The cooperative study to determine the value of various North American furs for felting was continued with the research department of one of the leading hat manufacturers. The fur of the mountain beaver and the hair of the guinea pig were found to have no felting properties. One hundred pelts from 60-day-old domestic rabbits were classified and graded for furriers' purposes. Doe skins produced 5 percent more usable blown fur suitable for hat making than an equal number of the same grade of buck skins and yielded 11 to 16 percent more usable fur than an equal weight of buck skins. Skins graded as No. 1 and No. 2 produced 16 to 27 percent more usable fur than those graded No. 3 and No. 4. The report on a cooperative study, mentioned last year, of the utility of jack rabbit and cottontail skins was issued in November as Miscellaneous Publication No. 289.

OTHER COOPERATIVE RESEARCH

Representatives of the Bureau have been cooperating with the Federal Trade Commission in the preparation of trade-practice rules for the fur industry, and a number of conferences were held in Washington and in New York. The rules promulgated were released June 17, 1938.

Results of analyses by specialists of the Meat Inspection Laboratory of the Bureau of Animal Industry of two composite samples of horse meat from eight carcasses, slaughtered for experimental feeding to fur animals, showed that muscle meat contained 75 percent of water, 20.2 of protein, 2.9 of fat, and 1.1 of ash; and that the viscera (blood included) contained 77.5 percent of water, 19.8 of protein, 1.25 of fat, and 1.1 of ash. The findings proved valuable to specialists in planning rations for experimental animals and also to fur farmers.

In cooperation with the foreign office of the Bureau of Agricultural Economics and the Committee for Reciprocity Information, representatives of this Bureau have been furnishing statistical data and other information pertaining to fur-farming developments in the United States and foreign countries. This was in connection with the import duty on silver fox pelts. A number of meetings were held in the offices of the Tariff Commission to give fur farmers an opportunity to present their views.

FUR ANIMAL EXPERIMENT STATION

The new office and laboratory building erected at the United States Fur Animal Experiment Station, at Saratoga Springs, N. Y., under W. P. A. funds, was occupied during October and provides facilities for better administrative

and experimental work. Through W. P. A. cooperation also additional pens for the animals were constructed, and there are now at the station 561 for minks, 369 for foxes, and 20 for martens. The building program, although planned some years ago, could not then be put into operation because until December 1936 the Federal Government did not own the land on which the station was located. It is hoped to complete construction during the coming year under W. P. A. grants, after which the experimental program can be resumed fully.

FOXES

A second year's feeding experiment corroborated previous findings that a ration containing 40 percent of raw meat (basis of added water) is as satisfactory as one having 60 percent when fed to vixens during gestation and lactation periods. One year's experimental work with summer and fall feeding of adult male foxes shows that beef meal alone is as satisfactory as the beef meal (4 parts) and liver meal (1 part) in a ration that is identical in other respects. This conclusion was based upon observations as to general health, fur shedding, food consumption, and average live weight. No information was obtained on the effect that such summer feeding has upon breeding performance the following spring.

Soybean oil meal produced by the hydraulic-pressure method was substituted for half the beef meal in the ration for summer and fall feeding of mature vixens. No raw meat was given. The normal trend of weights, general health as shown by appetite, and normal shedding of old fur indicate soybean oil meal to be a satisfactory substitute for some of the beef meal. A continuation of soybean oil meal as a substitute for some of the raw meat in the normal ration during breeding, gestation, and lactation seems to promise good results, though all production records of the vixens were poor because of disturbance incident to building operations at the station. It is interesting to note, however, that the adult vixens in the soybean oil meal group came in heat an average of 10 days earlier than those in other groups and produced more pups.

Ninety weaned pups of both sexes were fed until pelting time on rations planned to compare the relative value of 40 percent of raw meat (basis of added water) with beef meal (5 parts) and liver meal (1 part) and with soybean oil meal replacing half the beef meal. Though the group getting the raw meat weighed 0.75 pound more than the beef-meal group and 1.25 pounds more than the soybean oil meal group at the end of the experiment, the average length from nose to base of tail of the male pelts taken was not reduced. Fur-trade experts considered the pelts produced on the ration containing raw meat to have more tinge and less sheen, density, and length of guard hair, as well as less depth of underfur and life of pelt, than the other two groups. This problem is receiving further study. Preliminary data are still being gathered on the value of fish meal and peanut meal as substitutes for beef meal in the ration.

Further attempts were made during the year to produce foxes by artificial insemination through transfer of active semen from a vixen previously bred in the normal manner to one also determined to be in heat by observation and by testing with a male. Though one of the vixens appeared to be pregnant no young were born. Much information and improvement in technique were acquired for use in the continuation of this work.

Data on the most humane, efficient, and economical method of killing foxes for pelting are being gathered.

MINKS

Weaned mink kits were fed during the summer of 1937 on rations in which (1) canned fish and (2) a comparable quantity of fish meal on dry-matter basis were substituted for one-third of the raw-meat portion (45 percent on an added-water basis) of the ration. There was no apparent difference in any of the animals as to general health. Studies made during the last 8 weeks of the experiment failed to show any significant difference in color, quality, density, or primeness of the fur. Another year's experiments should be completed before definite conclusions are drawn.

Summer and fall experimental rations similar to those of the kits proved quite satisfactory when fed to adult minks. Experiments with tankage and liver meal as a summer feed for adult minks were reported on in a mimeographed leaflet (BS–112) as unsatisfactory.

Building-construction disturbances and an outbreak of distemper among the minks during the latter half of the year so affected production that no dependable information on this and other experimental feedings is available.

MARTENS

Despite the use of an especially nutritious ration only one litter of three young martens was produced this year. There are only seven male and nine female adult martens in captivity at the station, small numbers that handicap the research.

RABBIT EXPERIMENT STATION

Increasing requests for information from persons engaged in, or contemplating, rabbit raising tend to illustrate that the practical program of the research conducted at the United States Rabbit Experiment Station, Fontana, Calif., is becoming better understood and appreciated. Inquiries received increased 150 percent over those of the previous year, though the unemployed are in part responsible. About 200 4–H Club members visited the station to inspect its equipment and obtain first-hand information on production problems. The station is now equipped to handle in experimental work more than 4,000 rabbits a year. With this large number the element of error is greatly reduced and the value of the experiments enhanced.

Data resulting from a breeding experiment that involved 175 does divided into 25 lots of 7 each, mated first to sterile bucks and subsequently to normal bucks at intervals of 1 to 25 days, established the fact that more than 86 percent of the does failed to produce young after the normal gestation period when mated during the first 17 days after the sterile copulation. On being mated to a fertile buck, beginning on the eighteenth day and continuing through the twenty-fifth, 73 percent of the does, having passed through pseudopregnancy, later produced young. The definite knowledge that the false, or pseudopregnant, period lasts 17 days enables the rabbit breeder who has maintained his young does in groups for economy purposes, to separate them at least 17 days before attempting mating. It also gives him the assurance that test mating on the eighteenth day following mating will detect the largest number that failed to conceive.

A special lot of pseudopregnant does that were autopsied showed that activation of the mammary glands and the generative tract was most marked in the first 10 days of the period. At the 15-day stage these organs were involuting, and 18 days after the sterile mating the corpora lutea were disintegrating and the generative tract was approaching the size usual in nonpregnant does. The results of this research are being prepared for publication.

Twenty-six combinations of feeds were used in feeding experiments. Five generations of rabbits have been raised at lower cost on the whole-grain ration developed at the station and in use for 3½ years. An experiment to determine the relative value of various protein supplements in the diet was completed after 2½ years. A preliminary summary of the data indicates that self-fed does and their litters select a ration having a nutritive ratio (between digestible crude protein and the combined digestible carbohydrates and fat) from 1 : 2.8 to 1 : 4.5. It was found that protein meals must be pelleted in order to be satisfactorily fed with whole grain and that pea-size oil-meal cakes are satisfactory for balancing a ration. The experiments show that the addition of a good quality plant-protein supplement will increase the profit on a litter of seven rabbits by 80 cents at prevailing feed prices and market prices for live rabbits.

Because of the economical conversion of pounds of feed into pounds of rabbit meat, the self-feeding and full hand-feeding experiment is attracting more attention from commercial rabbit raisers than any other project. Butcher buyers are paying approximately 10 percent above market quotations for rabbits produced on the self-feeder because of the more uniform development and superior quality of the carcasses compared with those of the average fryer rabbits on the market.

An experiment is in progress to determine the effect of feeding combinations of a limited number of whole grains with pelleted peanut meal, so as to have information readily available on whole-grain rations adaptable to various sections of the United States. The protein level for all groups has been about the same. A preliminary summary shows that 3 to 3½ pounds of concentrates and

roughage combined are required to produce 1 pound of marketable fryer rabbit. Extensive data on all phases of rabbit production are being recorded to formulate a basis for developing a feeding standard.

Practically all the studies during the past 4 years in an effort to determine the factors that might be responsible for mucoid enteritis in rabbits have yielded negative results. Present information suggests that the trouble is nutritional and possibly due to vitamin deficiencies.

Several years of experimental study have shown that ¾-inch woven-wire-mesh floors cause sore hocks, that hardware cloth of ⅝-inch reduces this trouble materially, and that stamped metal floors eliminate it almost entirely. A cooling basket for young suckling rabbits was developed at the station and has been most favorably received by breeders. Details of its construction and use are set forth in a leaflet (BS–114) entitled "Care of Rabbits During Warm Weather." Another leaflet (BS–102), the Salt Requirements of Rabbits, was issued.

An address on various phases of experimental studies pertaining to the breeding of rabbits, given by the director of the station before the National Convention of Rabbit Breeders at Colorado Springs, was manifolded for correspondence uses as Leaflet BS–101, Principles of Rabbit Breeding. Other work relative to rabbit-production problems included discussions of experimental work with breeders in Kansas City, Mo., Memphis, Tenn., Birmingham, Ala., and Atlanta, Ga., and conferences with college officials in Mississippi and Alabama.

FUR ANIMAL FIELD STATION

The muskrat investigational work on the Blackwater Migratory Bird Refuge, Md., which was discontinued at the end of June 1934, was resumed this year. The 5,405 acres of marshland on this refuge produce annually 20,000 muskrat pelts. A preliminary report on the study was published in May as Circular No. 474, Muskrat Investigations in Dorchester County, Md., 1930–34.

An associate biologist and assistants were employed to conduct research work with muskrats in their natural habitat as well as in pens where feeding and breeding can be controlled. A careful count of all muskrat houses on the marsh was made this year in an effort to correlate pelt production and house density per acre. On 332 acres that produced 2,127 pelts, a count of old and new, large and small houses totaled 2,783. Other areas were less productive. The annual catch, segregated by color according to trapping areas, also was obtained from the entire refuge, thus providing comparable data for 6 consecutive years.

Several hundred reproductive tracts were removed from pelted muskrats to determine by microscopic study the period and processes of reproduction. Pelts were obtained every 10 days during the regular trapping season, January 1 to March 15, to demonstrate variations, if any, in the prime-fur period.

In a study, begun in June, of breeding activities on the marsh, weights and measurements of young were made and a total of 80 houses that indicated occupancy were opened but revealed only four litters. Under a cooperative understanding with the Bureau of Entomology and Plant Quarantine, collections of parasites have been made for identification, and more than 15,000 mites were obtained from one dead animal. The parasitic infestation is believed to be materially affecting the financial returns from the marsh. The color markings and odd colors (other than black and brown) have been given special study. Many unusually colored animals still alive in traps were put into pens for matings in order to develop information on the genetics of coat color. Colors varying from snow white to buff, gray fawn, and silver gray on different parts of the body have been observed, and also white tips on tails. These color variants are found more frequently in some marsh areas than others.

Though the Bureau does not consider that muskrat raising in pens would be a profitable undertaking, 52 animals are being kept enclosed for controlled research studies, including gestation period, inheritance of coat color, nutrition, periodical weights, and rate of growth. Through W. P. A. funds 61 pens of various types and sizes have been made available and some of these are fenced areas of the marsh itself.

A 5-acre plot has been planted to a variety of truck crops, which will be harvested and fed to the muskrats to determine their suitability for food. The experimental program will be materially enlarged during the coming year.

WILDLIFE-DISEASE CONTROL

FUR-ANIMAL DISEASES

A number of commercial silver fox farmers have enabled the Bureau to make practical tests of control measures designed to reduce losses from disease. On their fur farms large groups of animals were subjected to treatments with products prepared to prevent or cure sickness caused by organisms associated with canine distemper. In each trial three test groups of foxes were used and checked against a fourth lot of untreated animals, all the various sets being closely related.

It was shown that those receiving adequate doses of a properly prepared homologous serum were temporarily protected. Others receiving chemotherapy and bacterin treatments also showed resistance slightly above that of an untreated check group. Unfortunately the protection afforded by the homologous serum was largely lost within a period of 3 to 5 weeks. The immunization, however, was of sufficient duration to permit development of pelts much superior in quality to those of foxes affected earlier in the furring season. Urgent need is evident for additional research on the development of a more lasting or permanent immunity to the infections of foxes.

Increasing production of minks on fur farms also calls for extended research on the diseases of these animals.

For the benefit of producers of domestic rabbits a mimeographed leaflet (BS–116) Suggestions for Control of Coccidiosis in Rabbits, was issued, giving condensed practical information for use in handling this disease. A manual for fur farmers in general was issued in the Farmers' Bulletin series (No. 1777) under the title "Diseases of Fur Animals."

DUCK-SICKNESS CONTROL

At the Bear River Migratory Bird Refuge, Utah, intensive research on the cause of western duck sickness, or botulism, has disclosed the type of area most conducive to its incidence. For some time it has been known that not all feeding places in the alkaline mud flats are favorable to the disease-causing factor and that decaying organic matter, such as decomposing dead birds on the shore line, was a prolific source of the trouble. Extensive outbreaks have recently been shown to have their source in natural culture media consisting of combinations of organic matter, earth, and water, forming a characteristic ooze in which under suitable temperature rapid growth of the toxin-forming organism (*Clostridium botulinum*) ensues. A mimeographed leaflet (BS–99) on Disease as a Factor in Game Fluctuation was issued.

MALADIES OF PROPAGATED GAME BIRDS

Through cooperative field studies as well as laboratory examinations information has been developed on the diseases to which game birds are subject under artificial propagation. Farmers' Bulletin No. 1781, Diseases of Upland Game Birds, was issued to give game managers and others interested in game conservation general information on infectious, parasitic, and nutritional maladies affecting various species of propagated wild birds.

Special attention was given to incubation, brooding, and nutritional difficulties on game farms. It has been demonstrated in recent tests that pullorum disease, an infection widely distributed among domestic poultry, is seldom if ever important in captive quail. Observations also demonstrated the need for a carefully controlled brooding temperature and well-regulated rations. Many propagation plants were found to have achieved better results by maintaining incubators at slightly lower temperatures than formerly. Rations containing too high a percentage of protein, especially during hot weather, are known to cause losses.

Progress has been made in a study of the normal blood corpuscle count in both young and adult quail and in wild ducks. These investigations are of importance as a basis for understanding disease manifestations in the blood of sick birds.

FEDERAL AID IN WILDLIFE RESTORATION

With the approval on September 2, 1937, of the Pittman-Robertson Act, known also as the Federal Aid to Wildlife Restoration Act (50 Stat. 917), there was initiated a program that promises to become one of the most potent influences in

the history of American wildlife conservation. Under its authorization of annual appropriations not to exceed the excise tax on arms and ammuntion, which amount to about $3,250,000 a year, Congress on June 16, 1938, appropriated $1,000,000 for the first year's program, beginning July 1, 1938.

Emphasis is placed on the selection, restoration, rehabilitation, and improvement of land and water areas for wildlife purposes, and on research into problems of wildlife management. Areas unsuited for other economic uses are to be restored to game and fur production, thus providing additional sport for hunters and an increase in the income from the land.

Federal funds are apportioned to the States on the basis of land area and hunting licenses sold, and each State must contribute 25 percent of the cost of projects from its own resources. The State fish and game departments are named as the cooperating State agencies, and provision is made that all areas purchased are to be owned and maintained by the State departments. Federal funds will be expended on the basis of individual projects approved by the Chief of the Biological Survey, acting for the Secretary, in conformity with prescribed standards.

Although the act did not become effective until July 1, 1938, meetings were scheduled as early as November 1937 to discuss plans with representatives of the State game departments, and an explanatory leaflet (BS–105), The Federal Aid to Wildlife Restoration Act, was mimeographed and the public also informed by press statements and radio addresses. Regional conferences were held at Albuquerque, N. Mex.; Portland, Oreg.; Pocatello, Idaho; Omaha, Nebr.; Pierre, S. Dak.; Boston, Mass.; Jacksonville, Fla.; and New York, N. Y.; and two national conferences, one at Baltimore, Md., in connection with the Third Annual North American Wildlife Conference, and the other at Asheville, N. C., during the meeting of the International Association of Game, Fish, and Conservation Commissioners, afforded excellent opportunities to draft rules, regulations, and general policies after full discussions with representatives of the States.

Plans for the organization of a new Division of Federal Aid in Wildlife Restoration had been perfected and arrangements made for the approval of projects and disbursal of funds shortly after the close of this fiscal year.

ACQUISITION OF LANDS FOR REFUGES

Refuge-land acquisition was concerned principally with consolidating and extending the ownership of areas in existing refuges. Five new refuges, however, were acquired: The Back Bay Migratory Waterfowl Refuge, Va., 3,926 acres, through purchase; and the following four refuges, containing a total of 9,750 acres, by Executive orders: Hazen Bay Migratory Waterfowl Refuge, Alaska; Apache Migratory Waterfowl Refuge, Ariz.; Tybee Migratory Bird Refuge, Ga.; and Snake River Migratory Waterfowl Refuge, Idaho.

For rounding out 23 national wildlife refuges, the Migratory Bird Conservation Commission approved the purchase of 15,440 acres of land at a total cost of $314,581, or an average of $20.38 per acre. Many of the tracts involved are being taken by judicial proceedings because agreements on prices deemed equitable by the Bureau could not be reached with the owners or because legal entanglements in certain titles made it impossible to prepare contracts that would be binding.

The Survey's activities in land acquisition were unusual because of increased time taken up with suits in the Federal courts, instituted for the condemnation of lands that could not be otherwise acquired. There had also been transferred to the Bureau the responsibility for getting abstracts of titles and material to perfect titles and for taking the final steps looking to the closure of acquisition cases and making the payments for the lands purchased. This departure from the old practice is too recent to permit a definite statement that it has quickened the closure of purchase cases, but it is the general consensus that, without reflecting upon the agencies heretofore responsible for the work, there has been a marked improvement in this direction. The advantages grow out of the fact that representatives of the Biological Survey are more closely associated with the landowners who agreed to sell, and consequently, through personal contacts, can more rapidly close the transactions.

The Bureau's work in the acquisition of refuge lands by purchase is probably unique by reason of the purposes for which the lands are being acquired. Wildlife refuges cannot be wholly effective unless all of the lands within their exterior boundaries are under Survey jurisdiction and ownership. As a consequence, it

becomes necessary to obtain titles to the lands as quickly as possible by every legitimate means. Having once launched upon a refuge-acquisition program within a given unit of purchase, the negotiations for the acquisitions must be vigorously prosecuted and culminated within a minimum time. For this reason the Biological Survey usually finds itself confronted with a purchase problem that resolves itself into what is generally spoken of as a "seller's market."

Approximately 91 percent of all lands within the refuges being acquired by purchase are now in Government ownership and practically all the remainder are in more or less advanced stages of progress leading to the vesting of title in the United States. The residue are lands that within a very recent period have been found necessary to the refuge, and consequently the acquisition work has been under way only a short time.

It is also necessary promptly to define accurately on the ground the boundaries of refuges. The boundary surveys, which are made as rapidly as conditions warrant, involve the retracement of the original property lines. In many localities these were first laid down in pre-Revolutionary days. In most instances, except for lands in the far West, where the surveys are more recent, most of the original boundary lines and corners have been lost or obliterated. The problem of restoring these lines to their original locations involves a tedious and technical procedure, time-consuming and relatively costly, but nevertheless necessary to avoid boundary-line disputes, to facilitate administration, and to determine correctly the acreage of the lands being acquired, so as to make compensation to the vendors.

Approximately 75 percent of the Ruby Lake Migratory Waterfowl Refuge, Nev., has been paid for, and the remainder is now in the final stages of conveyance.

The titles to all lands within the Moosehorn Migratory Bird Refuge, Maine, have vested in the United States during the current year.

The original Bombay Hook Migratory Waterfowl Refuge, Del., has been completely acquired. Additional lands are now needed for administrative and development purposes, and the negotiation and acquisition work is now in process.

Acquisition was completed on the Savannah River Wildlife Refuge, Ga. and S. C., and on the Cape Romain Migratory Bird Refuge, S. C.

The Montezuma Migratory Waterfowl Refuge, N. Y., is about 50 percent acquired, and the titles to the remaining lands are being vested as rapidly as the difficult title situations permit.

Practically all the Aransas Migratory Waterfowl Refuge, Tex., has been acquired, except a few small parcels being taken by purchase and by condemnation.

In addition, miscellaneous parcels are being taken in other refuges to round out the program. Numerous special appraisals were made of small parcels needed for inclusion in existing refuges.

Besides 346 miles of refuge boundary lines surveyed, it was necessary to survey 290 additional miles of interior or contiguous lines by reason of lost and obliterated corners; 24 miles of level lines were surveyed, and to define the boundaries of existing refuges 277 miles were marked. Preliminary to fence construction, 166 miles of boundary lines were staked.

Survey descriptions necessary for title examinations and preparing deeds of conveyance for 268 tracts were completed for approximately 132,000 acres, of which 86,594 acres with irregular boundaries were surveyed preliminary to the preparation of descriptions to properly define the lands. More than 6,000 acres were surveyed for topography, and topographic maps therefrom were compiled.

The President signed 26 Executive orders prepared for the reservation of refuge lands, embracing 36,271 acres of the public domain and 276,185 acres acquired by purchase.

Details of the accomplishments in refuge acquisition are shown in table 4.

TABLE 4.—*Land for refuges and related uses acquired or in process of acquisition during the fiscal year 1938 under the Migratory Bird Conservation Act, with emergency and other funds, by gifts, and by Executive order*

State and county	Refuge	Under Migratory Bird Conservation Act			With emergency and other funds			Acquired other than by purchase	Total	Acquired in previous years
		Acquired by purchase	Pending title conveyance	Total	Acquired by purchase	Pending title conveyance	Total			
		Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Alaska: Fourth judicial division	Hazen Bay							[1] 6,800	6,800	
Arizona: Apache	Apache							[1] 2,514	2,514	
Arkansas: Arkansas, Desha, Monroe, and Phillips.	White River		529	529	1,482	6,715	[2 3 4] 8,197		8,726	94,932
Delaware: Kent	Bombay Hook	6,886	659	7,545					7,545	5,120
Florida: Jefferson, Taylor, and Wakulla	St. Marks	2,879	6,918	9,797		1,181	[2] 1,181	[1 5] 9,179	20,157	47,145
Georgia:										
Charlton, Clinch, and Ware	Okefenokee		833	833				[5] 11	844	292,982
Chatam	Savannah River (see also South Carolina).	31		31		1,462	[2] 1,462		1,493	3,921
Do	Tybee							[1] 100	100	
Idaho:										
Jefferson	Camas	200	3,350	3,550					3,550	6,692
Canyon	Deer Flat							[1 6] (2,121)	(2,121)	12,373
Bannock	Pocatello	1		1					1	1
Canyon	Snake River							[1] 336	336	
Illinois:										
Mason	Chautauqua				1,760	496	[3 4] 2,256		2,256	2,220
Carroll, Jo Daviess, Rock Island, and Whiteside.	Upper Mississippi (see also Iowa, Minnesota, and Wisconsin).									[7] 19,630
Iowa:										
Kossuth	Union Slough	430	231	661					661	200
Allamakee, Clayton, Clinton, Dubuque, Jackson, and Scott.	Upper Mississippi (see also Illinois, Minnesota, and Wisconsin).									[7] 29,827
Louisiana:										
Cameron	Lacassine	5,468	2,649	8,117	22,992		[2] 22,992	[1] 227	31,336	17
Do	Sabine				138,987		[2] 138,987		138,987	
Maine: Washington	Moosehorn	10,610	10	10,620					10,620	684
Michigan:										
Marquette	Huron							[1] 64	64	83
Schoolcraft	Seney	196	37,364	37,560	11,735	3,043	[2 3 4] 14,778		52,338	33,614

[1] Set aside by Executive order or proclamation.
[2] Federal Emergency Relief Administration and Resettlement Administration funds.
[3] $1,000,000 fund provided through Executive Order No. 6724, of May 28, 1934.
[4] $950,000 fund, a substitute for Executive Order No. 6724.
[5] Acquired by gift.
[6] Numbers in parentheses represent deductions and should be subtracted.
[7] Upper Mississippi River Wildlife and Fish Refuge fund.

TABLE 4.—*Land for refuges and related uses acquired or in process of acquisition during the fiscal year 1938 under the Migratory Bird Conservation Act, with emergency and other funds, by gifts, and by Executive order*—Continued

State and county	Refuge	Under Migratory Bird Conservation Act			With emergency and other funds			Acquired other than by purchase	Total	Acquired in previous years
		Acquired by purchase	Pending title conveyance	Total	Acquired by purchase	Pending title conveyance	Total			
		Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Minnesota:										
Aitkin	Rice Lake		1,423	1,423	2,935	4,854	[2] 7,789		9,212	661
Cottonwood	Talcot Lake					920	[5] 920		920	80
Becker	Tamarac	505	1,414	1,919					1,919	21,158
Houston, Wabasha, and Winona	Upper Mississippi (see also Illinois, Iowa, and Wisconsin).					1,874	[7] 1,874		1,874	[7] 22,370
Missouri:										
Holt	Squaw Creek				365	120	[2 3 4] 485		485	6,163
Chariton	Swan Lake		2,900	2,900	3	180	[2] 183		3,083	7,608
Montana:										
Phillips	Hewitt Lake							[1] 400	400	
Do	Lake Bowdoin				640		[2] 640		640	[8] 10,671
Hill	Lake Thibadeau							[1] 192	192	
Roosevelt and Sheridan	Medicine Lake				3,614		[2 3 4] 3,614	[5] 4	3,618	[8] 16,614
Beaverhead	Red Rock Lakes	231	771	1,002	590	8,503	[2] 9,093		10,095	16,526
Nebraska: Cherry	Valentine				1,159	276	[2 3 4] 1,435		1,435	64,373
Nevada:										
Humboldt and Washoe	Charles Sheldon (see also Oregon)	17,509	5,304	22,813					22,813	559,235
Elko and White Pine	Ruby Lake	20,745	7,667	28,412					28,412	
New Mexico:										
Chaves	Bitter Lake	120	6,935	7,055				[1] 11,316	18,371	3,193
Socorro	Bosque del Apache		2,926	2,926					2,926	52,843
New York: Seneca	Montezuma	2,564	3,656	6,220					6,220	
North Carolina:										
Hyde	Lake Mattamuskeet		541	541					541	49,925
Dare	Pea Island	1,605	2,702	4,307				[1] 32	4,339	1,539
North Dakota:										
Foster and Stutsman	Arrowwood				943	80	[2] 1,023		1,023	12,293
Burke and Ward	Des Lacs	2		2	837	608	[2 3 4] 1,445		1,447	12,359
Ramsey	Lake Alice		10	10					10	
Burke and Mountrail	Lostwood		373	373	480	1,208	[2] 1,688		2,061	21,723
Bottineau and McHenry	Lower Souris	5,618	1,243	6,861	803	2,144	[3 4] 2,947		9,808	44,016
Renville and Ward	Upper Souris	317	708	1,025	809	409	[2] 1,218		2,243	29,359
Oklahoma: Alfalfa	Salt Plains							[1] 6	6	19,453

Oregon:										
Lake	Charles Sheldon (see also Nevada).		627	627					627	
Do	Hart Mountain	1,811	2,421	4,232					4,232	212,004
Harney	Malheur:									
	Blitzen Unit		320	320					320	65,722
	Malheur Unit		317	317	141		[3 4] 141		458	93,346
Marion	Willamette		343	343					343	
South Carolina:										
Charleston	Cape Romain	3		3					3	62,907
Jasper	Savannah River (see also Georgia).		617	617	530		[2 3 4] 530		1,147	6,078
South Dakota:										
Brown	Sand Lake				340	458	[2] 798		798	19,157
Day	Waubay		29	29					29	2,557
Tennessee: Lake and Obion	Lake Isom					1,517	[2] 1,517		1,517	20
Texas:										
Aransas and Refugio	Aransas	45,597	903	46,500					46,500	
Bailey	Muleshoe	1,417	738	2,155		1,440	[2] 1,440		3,595	2,214
Utah: Box Elder	Bear River	2	39	41	3,144		[3 4] 3,144		3,185	53,979
Virginia: Princess Anne	Back Bay	3,926	663	4,589					4,589	
Washington:										
Spokane	Turnbull	1,925	4,866	6,791					6,791	5,412
Pacific	Willapa Harbor	40	660	700					700	2,230
Wisconsin: Buffalo, Crawford, Grant, La Crosse, Trempealeau, and Vernon.	Upper Mississippi (see also Illinois, Iowa, and Minnesota).					321	[7] 321		321	[7] 71,103
Wyoming:										
Teton	Elk Refuge	1,557	641	2,198				[1] 618	2,816	[9] 17,621
Do	Flat Creek							[1 6 10](40)	(40)	40
Total		132,195	104,300	236,495	194,289	37,809	232,098	29,638	498,231	[11]

[1] Set aside by Executive order or proclamation.
[2] Federal Emergency Relief Administration and Resettlement Administration funds.
[3] $1,000,000 fund provided through Executive Order No. 6724, of May 28, 1934.
[4] $950,000 fund, a substitute for Executive Order No. 6724.
[5] Acquired by gift.
[6] Numbers in parentheses represent deductions and should be subtracted.
[7] Upper Mississippi River Wildlife and Fish Refuge fund.
[8] Revised acreage.
[9] In addition to the acreage shown, 3,858 acres are held under lease.
[10] The Flat Creek Refuge was merged by Executive order, and is now a part of the Elk Refuge, which it adjoined.
[11] Total omitted, as entries in column are for only those refuges on which acquisition work was involved during the year.

NOTE.—1-acre items range from a fraction of an acre to 1.49 acres.

RESTORATION OF WILDLIFE HABITAT BY THE REFUGE PROGRAM

The continued program of wildlife restoration has resulted in the provision of additional areas where various forms of wildlife, especially waterfowl, are given protection and a chance to increase their numbers. Conditions for wildlife have been improved on the Federal refuges by stabilizing impounded waters, planting wildfowl foods and food-producing trees and shrubs, constructing nesting islands and upland game shelters, and providing other facilities tending to make the areas better serve their purpose. Waterfowl have increased in numbers on the refuges and are beginning to spread from them over the adjacent country.

Although many of the areas acquired by the Bureau for wildlife conservation needed only protection to make them attract large numbers of birds, it has been definitely proved that their drawing power can be greatly enhanced. Through the use of labor provided by emergency funds the development of refuge lands has gone forward rapidly.

REFUGE DEVELOPMENT BY C. C. C. CAMPS

Thirty-five C. C. C. camps and three side camps were engaged during parts or all of the year in the development of 32 national wildlife refuges. The type of work and the objectives have been discussed in previous reports, so that here only the twofold objective need be stated: To make such improvements on the refuges as will (1) increase their attractiveness to wildlife and (2) facilitate their administration. The camps in operation this year were as follows—the six starred (*) were at new locations:

White River Migratory Waterfowl Refuge: Arkansas Camps BF–1, 2, and 3.
Tule Lake and adjacent Migratory Waterfowl Refuges: California Camp BF–1.
Sacramento Migratory Waterfowl Refuge: California Camp BF–2.
*Bombay Hook Migratory Waterfowl Refuge: Delaware Camp BF–1.
St. Marks Migratory Bird Refuge: Florida Camp BF–1.
Okefenokee Migratory Waterfowl Refuge: Georgia Camp BF–1.
Seney Migratory Waterfowl Refuge: Michigan Camp BF–1.
Mud Lake Migratory Waterfowl Refuge: Minnesota Camp BF–1.
Tamarac Migratory Waterfowl Refuge: Minnesota Camp BF–2.
*Swan Lake Migratory Waterfowl Refuge: Missouri Camp BF–2.
Medicine Lake Migratory Waterfowl Refuge:: Montana Camp BF–2.
Valentine Migratory Waterfowl Refuge: Nebraska Camp BF–1.
Charles Sheldon Antelope Refuge: Nevada Camp BF–2.
*Montezuma Migratory Bird Refuge: New York Camp BF–1.
Pea Island Migratory Waterfowl Refuge: North Carolina Camp BF–2.
Mattamuskeet Migratory Waterfowl Refuge: North Carolina Camp BF–3.
Upper Souris Migratory Waterfowl Refuge: North Dakota Camps BF–1 and 5.
Arrowwood Migratory Waterfowl Refuge: North Dakota Camp BF–2.
Des Lacs Migratory Waterfowl Refuge: North Dakota Camp BF–3.
Lower Souris Migratory Waterfowl Refugee: North Dakota Camp BF–4.
Wichita Mountains Wildlife Refuge: Oklahoma Camps BF–1 and 2.
Malheur Migratory Waterfowl Refuge: Oregon Camps BF–1, 2, and 3.
*Hart Mountain Antelope Refuge: Oregon Camp BF–4.
Savannah River Migratory Waterfowl Refuge: South Carolina Camp BF–1.
*Cape Romain Migratory Waterfowl Refuge: South Carolina Camp BF–2.
Sand Lake Migratory Waterfowl Refuge: South Dakota Camp BF–2.
Lacreek Migratory Waterfowl Refuge: South Dakota Camp BF–3.
Bear River Migratory Bird Refuge: Utah Camp BF–1.
*Back Bay Migratory Waterfowl Refuge: Virginia Camp BF–1.

With the exception of State-owned areas at Ogden Bay, Utah, and Howland Island, N. Y., all work was on Federal land.

TYPICAL C. C. C. WORK—VALENTINE REFUGE

Differences in topography, water supply, climate, and rainfall, and in the wildlife species primarily served, make the development problems at each refuge different in some respects from those at all others. The C. C. C. work accomplished under the technical supervision of the Bureau at the 69,000-acre Valentine Migratory Waterfowl Refuge, Nebr., however, is typical of that at other refuges, and as an illustrative example may be discussed in some detail.

When acquired in 1935 for development as a refuge, this area, which is favorably situated in the Central waterfowl flyway and includes 15 important lakes, in the heart of the sand hills of Cherry County, Nebr., had been hard hit by drought, erosion, and uncontrolled grazing. As a consequence it had deteriorated biologically. The progressive lowering of the water tables during the past 15 or 20 years was sharply accentuated by drought in the early 1930's. The general lack of moisture greatly lowered the levels of the lakes early each

summer, and many of the marshes dried up completely during late summer and early fall.

C. C. C. boys were used on projects designed to impound sufficient water to carry the birds through the breeding season. A dam across Gordon Creek stores the spring run-off, which is drawn upon and conveyed 4 miles by ditch to Hackberry Lake so as to maintain optimum levels during the critical breeding season. Dikes were built to hold the water in many of the lakes, 15 wells were dug, and as a further protection against losses by drought, a large number of pot holes were excavated in and adjacent to the marshes. These holes are about 150 to 200 feet long, 60 to 90 feet wide, and 5 to 6 feet deep. Because of their depth, they will provide insurance against complete drought even in the driest years. In excavating them, 55,400 cubic yards of earth were removed. In addition, 140 man days were used in creating open-water areas throughout the marshes so as to provide a better breeding and feeding habitat for migratory birds.

A project of direct and important benefit to wildlife was the propagation of food- and cover-producing plants and shrubs. Here was an opportunity for biological rehabilitation on a large scale. The drought and scorching winds had denuded the sand hills of almost all vegetation. Even plants indigenous to the area could not withstand the drought. After improvements, with water levels protected, the marshes and lakes were planted with many varieties of aquatic plants. Species were selected that would provide food and also shelter from natural enemies and storms. A seed and tuber cellar was constructed for storing planting stocks until they can be set out to best advantage, and 1,850 pounds of seeds, including wildrice and other food-producing plants, were gathered and stored. In addition to the marsh and water areas, 260 acres of upland, in plots ranging in size from ½ to 2 acres and distributed throughout the refuge, were planted to food and cover vegetation.

In the nursery at Valentine approximately 1,000,000 tree seedlings were grown. Most of these were planted in the food and cover plots on the refuge, but many were shipped to other refuges. During the winter months 366 junipers and ponderosa pines, ranging in height from 6 to 8 feet, were planted. A pump house was built from which to supply water to the nursery.

One of the first projects was the fencing of the boundary line. This involved construction of more than 100 miles of fence, with steel and wood posts placed alternately, and required several hundred miles of wire and about 30,000 wood posts, which were peeled and treated with creosote. At points where needed, 20 automobile gates were constructed, and 35 directional or warning signs were made and erected.

As the refuge comprises more than 100 square miles, there has been the problem of furnishing trails for fire-protection patrol and for giving access to recreational areas. Forty-seven and one-half miles of truck trails were made and surfaced either with clay or with black topsoil, and to check erosion hundreds of tons of hay and rushes, cut from the roadsides, were used as mulch.

When the great drought of recent years ended, range grasses, protected from overgrazing, again began to cover the sand hills. Because of the constant danger of disastrous prairie fires, it was necessary to make more than 120 miles of firebreaks. These consist of two parallel plowed strips spaced 30 to 50 feet apart. In cutting vegetation between these strips and along the truck trails, 490 man-days of enrollee labor were used.

At two of the highest points on the refuge 100-foot lookout towers were erected as observation posts for the detection of fire and trespassers. About 18½ miles of telephone line were constructed to provide communication facilities between headquarters and patrol stations.

The headquarters buildings were all erected with the aid of the C. C. C.; that is, enrollees were used as assistants to the carpenters, masons, and other skilled mechanics. The refuge is situated on a very poor road approximately 35 miles from Valentine, Nebr., and a permanent headquarters for the management and supervision of the refuge is, therefore, essential. Six cinder-block buildings—a residence, office and laboratory, pump house, service building, machine shop, and bird house—were constructed. As a secondary headquarters, from which the activities in the southeastern part of the refuge will be directed, the C. C. C. has constructed cabins for the use of patrolmen and barns that may be used to house either automobiles or horses. Materials salvaged from buildings razed by the enrollees were largely used.

The recreational facilities provided by the C. C. C. are extremely important in this semiarid country. On one of the lakes, noted for fine fishing, these

included such necessities as overnight cabins, wells, picnic grounds, and toilets. This area is open to the public, but its use is so supervised as to avoid interference with the wildlife.

JOB-TRAINING AND EDUCATIONAL PROGRAMS

Special mention should be made of the educational program in Biological Survey C. C. C. camps. The development of a refuge involves the application of a diversity of sciences—hydraulics, structural and mechanical engineering, biology, botany, agriculture, and forestry—and many kinds of mechanical equipment are used. There are, therefore, unusual opportunities for the correlation of classroom instruction with everyday field operations.

At each camp there was an average each month of 31 classroom meetings, with an average of more than 15 enrollees attending. Prominent among courses offered were those in automobile mechanics, cabinetmaking and carpentry, dragline operation and maintenance, surveying, stone masonry, bricklaying, and office filing.

Much of the classroom instruction was put to immediate use and was supplemented on the job. At every camp enrollees assisted skilled mechanics and foremen in the construction of camp buildings, offices, shops, garages, seed and tuber cellars, lookout towers, warehouses, and bridges of timber and steel and concrete. For example, enrollees were taught to make concrete both by hand and by machinery, to build the necessary forms for pouring, to set the steel, and to finish the concrete.

As dam and dike construction, the excavation of diversion ditches, and other large earth-moving jobs require a variety of heavy equipment, those enrollees who in classrooms showed an aptitude for mechanical work were given opportunity to learn how to operate and repair trucks, draglines, power shovels, elevating and road graders, and tractors. Enrollee truck and tractor drivers were taught to care for and make minor repairs to the machines, and those with exceptional mechanical ability were assigned to the repair shops to assist the regular mechanics.

At the end of the year 75, or more than 1 of every 5, of the auxiliary personnel regularly employed by the Biological Survey in its C. C. C. camps were former enrollees. Among these 75 ex-enrollees were 5 dragline operators, 5 machine operators, 11 mechanics, 18 clerks, 19 squad foremen, and 5 junior foremen. In 80 percent of these cases the individual became qualified for the particular job as a direct result of instruction received as a part of the C. C. C. educational program. This demonstrates the practicability of achieving a close correlation between the training program and employment opportunities. The Survey leads all other organizations in percentage of employments from the enrollee ranks.

SAFETY PROGRAM

Efforts were made to provide safe working conditions for the enrollees and to enforce safety regulations. This resulted in a marked decrease in both the frequency and severity of accidents. In the first half of the year, 450,033 man days of enrollee labor were used on Biological Survey projects, and during that period 119 lost-time accidents were reported, whereas in the second half of the year only 81 such accidents occurred in 496,267 enrollee man days of work. Two camps had no lost-time accidents, and there were no fatal accidents in any of the 35.

COOPERATION OF THE WORKS PROGRESS ADMINISTRATION

Allotments totaling $1,583,646 were made to the Biological Survey by the W. P. A., under the E. R. A. Act of 1937 for the purpose of carrying on refuge projects designed to provide employment for those in need of relief and at the same time improve conditions for wildlife. These funds have enabled the Bureau to continue the development of water- and wildlife-conservation projects by means of dams, dikes, spillways, diversion ditches, and other water-controlling and water-saving structures; by planting erosion-resisting and food-producing grasses, shrubs, and trees; constructing trails, nesting islands, and game shelters; building and repairing fences, buildings, and other structures; developing recreational and other public facilities; and marking and posting refuge boundaries. It has been possible, through the use of these funds also

to initiate development on many of the newly acquired refuges and in the Great Plains States to continue improvement of the easement refuges that have proved so successful in supplementing the major refuge system. The easement refuges are of great value for flood control, stock watering, and public recreation, as well as for wildlife.

The W. P. A. program of the Bureau has met with the approval of the communities in which the projects are located, not only because they have afforded work to those in need, but also because they are in themselves of distinct public advantage. Work was done through this medium on 73 refuges in the following States: North Dakota, South Dakota, Nebraska, Montana, Wyoming, Idaho, Minnesota, Wisconsin, Michigan, Illinois, Missouri, Arkansas, Oklahoma, Texas, Louisiana, Georgia, South Carolina, Maryland, Delaware, New York, and Maine.

Through an understanding with the W. P. A., all project applications submitted to that organization involving drainage are now referred to the Biological Survey for review to determine their effect on wildlife. Many projects involving drainage operations have in the past resulted in the unwarranted destruction of valuable wildlife habitat, but since project applications have been submitted to the Bureau, many wildlife marshes have been saved. Very often it has been found possible to preserve the wildlife values of an area through modification of the plans and operating procedures and still accomplish the results desired by sponsors of a project. In addition to the W. P. A. field allotment, the Biological Survey received $7,166.88 to employ 18 statistical and clerical relief workers for a period of 6 months in the Washington office.

COOPERATION OF NATIONAL YOUTH ADMINISTRATION

National Youth Administration labor also was utilized, chiefly on refuges in the Great Plains States, particularly on the easement refuges in North Dakota. The duties of the young men consist of observing wildlife, making nest and brood studies, repairing fences and signs, cleaning out ditches, gathering and planting seeds, and caring for thousands of newly planted trees. It would be difficult to accomplish this kind of work without this type of help. The comprehensive reports submitted by the young men each week keep the Biological Survey personnel in charge of the refuges constantly informed as to the varying conditions of water and wildlife.

ENGINEERING WORK FOR REFUGE DEVELOPMENT

The Bureau of Agricultural Engineering has continued its cooperation with the Bureau of Biological Survey in the supervision and execution of engineering work on the refuges. The assistance rendered included reconnaissance surveys for determining developmental possibilities, preparation of contour maps to facilitate the control of water so as to produce conditions favorable for wildlife, studies of underground water to determine existing water-table elevations and their fluctuations, and preparation of designs for structures on both existing and proposed refuges. With this cooperation, investigational and constructional work was accomplished on 60 areas.

Hydraulic engineers of the Biological Survey attended to the filing of water rights, protecting water supplies, and negotiating with various Government and State agencies on matters involving the use of the water on or affecting the refuges.

BIOLOGICAL DEVELOPMENT OF REFUGE AREAS

FOOD AND COVER PLANTINGS

The establishment of adequate food and cover for all forms of wildlife is an important phase of the biological development of proposed and existing refuges. Toward that end, more than 2,000,000 trees and shrubs were planted. This work was materially aided by transfer of large quantities of stock from the Forest Service and Soil Conservation Service. Part of the stock was set in lining-out plots pending sufficient development for use in the permanent locations selected.

As a measure of economy, refuge nurseries, with two exceptions, are being eliminated; one of these is on the Lower Souris Refuge, N. Dak., and the other on the Valentine Refuge, Nebr. Hereafter the refuge personnel will collect

seeds of desirable species and turn them over to a Forest Service or Soil Conservation Service nursery for the production of planting stock.

It was determined, through tests conducted on the Valentine Refuge, that the seeds of duckpotato (*Sagittaria*) have a high germinating capacity (up to 92 percent). They are readily collected, stored, transported, and planted, and at a much lower cost than the planting of tubers. It is hoped by their use to establish this species over larger areas. The duckpotato is an important food of swans and geese on the Mattamuskeet Refuge, N. C., and of the rare trumpeter swan on the Red Rock Lakes Refuge, Mont. In view of the shortage of the local food supply for these birds, extensive shoal-water areas will be sown with duckpotato seed. This should not only increase the food for the larger waterfowl but also control wave erosion, which tends to keep the water roily, thus inhibiting the development of desirable submerged aquatic vegetation. The successful introduction of saltmarsh bulrush (*Scirpus robustus*) far north of its present range indicates that this species may be important in augmenting the wildfowl food supply on the prairie sloughs.

Despite the fact that comparatively little propagating material of desirable species was available for collecting or planting last year, more than 50,000 pounds of seeds and tubers were sown. About 10,000 pounds of Muhlenberg's smartweed and wild millet were planted on earth-fill dikes to protect these structures from wave erosion and also to produce additional food. Hardstem bulrushes (*Scirpus acutus*) were extensively planted in many of the shoal-water areas, as well as along the dikes. These rushes are effective wave breakers and also supply excellent cover and some food for waterfowl.

About 4,600 acres of grain, mostly corn, barley, and winter wheat, were sown to furnish food during critical periods when natural supplies are either exhausted or unavailable. Well over 200,000 pounds of grain were harvested to use for feeding upland game birds and waterfowl and in reseeding. Rye and oats are now known to be of secondary importance in attracting birds, and extensive plantings of these species will be discontinued.

IMPROVED FACILITIES FOR NESTING AND SHELTER

The excavation of pot holes and the impoundment of water behind small coulee dams have created additional nesting habitats more acceptable to many species of ducks than the larger water areas. Together with further construction of nesting islands, they have favored substantially increased nesting populations. In some instances the increase has been more than 100 percent, and on the nesting islands, where predation is at a minimum, as many as 13 nests per acre have been found.

Many nesting boxes have been constructed and set up for tree-nesting ducks. Made to resemble a hollow trunk or natural cavity in the bole of a tree, these boxes have substantially increased the number of goldeneyes and wood ducks nesting on the refuges. In the absence of more desirable dens several nesting boxes have been appropriated also by raccoons, opossums, and squirrels.

The upland game shelters previously established were carefully studied to determine their value. On the basis of these observations additional winter shelters and feeding stations were constructed at favorable locations. Frequently 30 to 50 birds visited a single feeder in 1 day during inclement weather. The following were reported using the shelters during the winter: Sharp-tailed grouse, prairie chickens, ruffed grouse, bobwhites, Hungarian partridges, and ring-necked pheasants. During the course of a winter thousands of game birds seek food and cover in the shelters provided.

CONTROL OF PREDATORS AND PESTS

Concurrent with improvement of environmental conditions, it has been necessary to control predators attracted by concentrations of waterfowl and other game birds. Within its range the skunk continues to be a major predator, while in other areas the bull snake is of ranking importance. Other common predators are coyotes, weasels, turtles, crows, and magpies. Control campaigns on nesting refuges, based on careful study and field observation, have reduced the predation on duck eggs from 50 percent to 10 percent.

In several areas, hordes of grasshoppers threatened to destroy plantings newly established in the interests of wildlife conservation. Field crops grown to supply winter food were consumed. Hundreds of trees and shrubs were stripped of their

leaves, and often the tender bark of the smaller trees was completely removed. In an effort to check the damage the field personnel entered into an extensive control campaign in cooperation with local officials and met with a measure of success in protecting the vegetation on the refuges, as well as farm crops on adjacent lands.

ADMINISTRATION OF NATIONAL WILDLIFE REFUGES

At the beginning of the year 231 national wildlife refuges, aggregating 11,482,374 acres were under administration, and by the end of the year the number had been increased to 248, and the acreage to 11,650,358. Of these refuges, 232 are in the United States (7,557,221 acres) and 16 are in Alaska, Hawaii, and Puerto Rico (acreage estimated as 4,093,137). In addition, the Survey administers 14 smaller experimental and administrative units totaling 9,791 acres, on which also wildlife is protected. The classification of the 248 refuges and their acreage are shown in table 5.

TABLE 5.—*Number and extent of national wildlife refuges administered by the Bureau of Biological Survey*

Classification	Number	Acres
Migratory-waterfowl refuges (including easement refuges)	140	1,537,298
Refuges for other migratory birds	60	917,332
Wildlife refuges (for birds, mammals, and others forms)	10	4,062,894
Refuges chiefly for nongame birds	28	105,537
Big-game preserves and ranges [1]	10	5,027,297
Total	248	11,650,358

[1] The 2 Charles Sheldon antelope preserves, Nev., are now combined under a single administration.

PATROL AND MAINTENANCE

Patrol and maintenance have become items of major importance in the administration of the continental system of wildlife refuges. With the completion of the major development on many of the refuges and the consequent withdrawal of C. C. C. and W. P. A. forces, the administering personnel has been increased to protect the refuges properly against trespass and vandalism, and additional employees have been required to handle the enormous problems of predator control and grazing, haying, and other farming operations. Initiation of sharecropping agreements, by which local people may participate in the benefits derived from proper land use, again has increased responsibilities on the refuges.

Recreational use of the refuges also has gained rapidly as a result of the creation of lakes and ponds and the establishment of small picnic and other areas where local people may enjoy the out of doors and see something of the wildlife that is being protected by the Bureau.

Maintenance of the extensive water-impoundment structures is in itself a major undertaking and requires a staff of trained men and much specialized equipment to insure against damage by wind, water, ground-burrowing mammals, and other causes.

The laws and regulations for the administration of national wildlife refuges were published in the Service and Regulatory Announcement series (B. S. 90).

BIRD REFUGES

INCREASING VALUE TO WILDLIFE

There is no doubt that wildlife populations are benefited by the refuge system controlled by the Biological Survey. Each year sees an increase in the number of birds frequenting the refuges, and each year a few species never before seen in the vicinity of a particular refuge occur there. That the year just closed was no exception may be noted from the following comments on general conditions and on the results obtained from the Bureau's program of protection, establishment of additional water areas, construction of nesting islands, and other developments for the conservation of the important re-

source in bird life, under which even better results have been produced in many cases than anticipated. In addition to the general observations, some of the more important details are given for a few representative refuges, both bird and big game.

A total population of about 1,500,000 birds used the Sand Lake Refuge, S. Dak. Of this number about 441,500 were ducks and geese, 444,000 Franklin's gulls, 75,500 other water and shore birds, 5,000 upland game birds, and the remainder songbirds. A total of 220 species of birds was identified on the refuge, of which 86 nested and 27 were seen there for the first time. Two nests of the white pelican were found on one of the artificial nesting islands—the only nesting record of this species in the State for many years.

Canvasback ducks, first reported as nesting on the Malheur Refuge, Oreg., in 1937, increased in 1938, when 11 nests and 2 broods of young were found prior to June 30. Birds now known to nest on this refuge number 117 species, including 13 kinds of ducks.

At the peak of the fall migration, 1,250,000 waterfowl were estimated to be using the Bear River Refuge, Utah. This represents a decided increase over the number present during the fall migration of the year before. Canada geese were unusually abundant during the spring migration. Several nests of the black-crowned night heron were found there as early as March 21, with the eggs hatched and the young birds in a healthy condition, while a fresh fall of snow covered the edge of the nests.

A decided increase was reported in the number of baldpates, blue-winged teals, redheads, and ruddy ducks using the Lake Bowdoin Refuge, Mont., during migration periods. The largest flight for years was reported for the Crescent Lake Refuge, Nebr., and the Boulder Canyon Refuge, Ariz. and Nev.

The nesting season on the Lower Souris Refuge, N. Dak., was not complete at the time of this writing, but an increase of a third to a half in the number of young ducks produced is reported. Five pairs of captive Canada geese nested and produced 18 young. These captives are the first birds of this species to nest on the area since it became a refuge, although they nested in large numbers locally before the Souris Valley was drained in the early 1900's. To prevent fighting, the birds were released during the nesting period, but all were driven back into the pen afterward. With these geese scattered over the marshes, migrating Canada geese should be induced to stop and nest.

Three water birds new to the Lower Souris Refuge nested, namely, Franklin's gull, horned grebe, and western grebe; and the first nests of Cooper's hawk, sharp-shinned hawk, bluebird, and phoebe were noted. These bring the total of birds observed nesting on this important refuge to 112 species, including 14 of ducks. White-tailed deer have increased at least 100 percent since 1935 and are now common over the refuge.

The largest spring run-off since the establishment of the Des Lacs Refuge, N. Dak., greatly improved waterfowl conditions there. During the spring and summer of 1938, 10,000 ducks used the refuge, as compared with 2,000 in 1937. About 2,500 young ducks have been produced up to the time of this report, principally pintails, shovelers, mallards, gadwalls, and blue-winged teals. A few horned grebes nested there for the first time. At least 100,000 shore birds were noted about Upper Des Lacs Lake in July.

Waterfowl conditions are also much improved on the nearby Lostwood Refuge, N. Dak., where the horned grebe, eared grebe, green-winged teal, and black tern nested for the first time since its establishment.

On the Mattamuskeet Refuge, N. C., geese increased from 15,000 in the winter of 1934–35 to 60,000 in 1937–38, and whistling swans from 5,000 to 16,000.

The trumpeter swan, which is now found only on the Red Rock Lakes Refuge, Mont., and the nearby Yellowstone National Park, is just about holding its own. Two years ago only 115 of these birds were counted in the United States; last year the number increased to 158; and this year, while only 148 were counted, an apparent decrease of 10, it is thought that not all the cygnets (young birds) were seen when the count was made. Of the 55 cygnets thus far seen, 51 were on the refuge (same number last year) and 4 in the park (last year 26). Last year there were 81 adults, and this year 93, of which 47 were in the park and 46 on the refuge.

EASEMENT REFUGES

The easement-refuge program, which was begun in North Dakota in 1935 and under which landowners grant to the Federal Government perpetual easements

that permit the development and operation of areas as waterfowl refuges, was extended into Montana and South Dakota. It now includes a total of 81 units, aggregating 135,113 acres, as compared with 75 in 1937, covering 118,777 acres. North Dakota has 71 of these, comprising 111,580 acres; Montana, 8, with 22,931 acres; and South Dakota, 2, with 602 acres.

The program in North Dakota is well on the way to completion, and results are apparent in the increased use of refuges by birds. The winter of 1937–38 saw the completion of the major water-impoundment structures on all projects in the State, and in the spring the areas were for the first time in condition to catch the run-off. Before the close of the year 35 of the 71 impoundments had reached spillway elevations. Others were from half to three-fourths full, and all had enough water to take care of young birds hatched within or near their boundaries.

Seven of the eight cabins planned for the largest of the North Dakota easement areas were completed and their grounds leveled and planted to grasses, trees, and shrubs. Three additional lookout towers were completed and several wells dug. W. P. A. carpenters constructed all the furniture used in the cabins, as well as several boats, large refuge signs, and desks, filing cabinets, and other office equipment. All fencing of cabin sites and water-impounding structures was completed, and small areas in which plants are being propagated were fenced for protection against livestock. All major dams and spillways and several roads were completed and all areas posted. In all, 280,480 trees and shrubs were planted on the areas that needed them most; and 8,829 pounds of seeds, including those of shrubs, cover plants, and aquatics, were collected on certain of the refuges where they grew in abundance and planted on others.

The spring of 1938 saw a noticeable increase in the number of birds using the North Dakota easement areas. In one marsh on the Long Lake Refuge it was estimated that there were more than 10,000 nests of Franklin's gulls. Since these birds feed their young almost entirely on grasshoppers, the quantity of these insects destroyed by this colony alone was enormous and their destruction a great boon to nearby farmers. The Chase Lake Refuge, the only breeding place in the State for pelicans, cormorants, and ring-billed and California gulls, produced larger numbers of these species than for many seasons past. One of the largest flights of geese seen in the State in recent years visited the easement refuges, and an exceptionally large flight of lesser scaups and ruddy ducks also stopped on them during spring migration.

The permanent recreational areas developed on several of the easement refuges were visited by several thousand people. On one Sunday more than 1,200 people picnicked on the recreational area on the Lake Ilo Refuge, near Dunn Center. The regard in which the people of North Dakota hold the Bureau's easement program is evidenced not only by the fact that the landowners and other residents have granted the perpetual easements but also by the letters and verbal comments of landowners, sportsmen, and businessmen and by the fact that various county and other political subdivisions have lent their facilities and equipment and have otherwise given their support and assistance. Particularly noteworthy is the fact that in spite of an exceptionally large flight of waterfowl this spring, not one instance of law violation on the easement refuges came to the attention of the Biological Survey.

Although the easement program in South Dakota and Montana is younger than that in North Dakota, progress has been made there in the establishment and development of several refuges, and a few areas, which were near enough completion to impound water, attracted waterfowl and other wildlife in sufficient numbers to indicate their future value in wildlife conservation. Easement refuges established during the year are listed in table 6.

TABLE 6.—*Bird refuges established during the fiscal year 1938, by gratuitous easements to the Federal Government*

State and refuge	County	Area	State and refuge	County	Area
Montana:		*Acres*	North Dakota:		*Acres*
Greedmans Coulee	Hill	3,360	Brumba	Towner	1,977
Hailstone	Stillwater	2,266	South Dakota:		
Halfbreed Lake	do	3,080	Twin Lakes	Miner	277
Lamesteer Reservoir	Wibaux	800			
			Total		11,760

OKEFENOKEE WILDLIFE REFUGE, GA.

The end of the fiscal year was also the conclusion of the first full year's administration of the Okefenokee Wildlife Refuge, in Charlton, Clinch, and Ware Counties, Ga., which at present comprises 293,826 acres of the vast Okefenokee Swamp. It extends from about 4 miles north of the Florida-Georgia line to within 10 miles of Waycross.

In administering this great wilderness area the Biological Survey is keeping it in as nearly a natural condition as possible. The C. C. C. camp there is engaged only in the necessary work of constructing a few trails on the edge of the swamp and in clearing out a canal 12 miles long to facilitate patrol. All travel within the swamp proper will be by boat runs and foot trails. The outside boundaries of the refuge are being posted, and for the purpose of administration, a group of headquarters buildings are being constructed on adjacent high ground. Most of the improvements undertaken by the C. C. C. camp are being done outside rather than in the swamp.

The complete protection given the area even during only 1 year has resulted in noteworthy increases in the numbers of many species of wildlife. Although the ducks congregating there had dwindled in recent years from hundreds of thousands to less than 12,000, an upward trend to about 25,000 was noted. The increase of wood ducks is particularly outstanding. Before the acquisition of the swamp by the Survey, these birds were hunted before the young could fly, and many were killed at their roosting places. The stopping of this slaughter has resulted in great increase.

Among the interesting birds making their home on the Okefenokee Refuge, many of which are badly in need of protection, are Florida crane, definitely on the increase; water turkey; swallow-tailed kite; great blue, Louisiana, little blue, Ward's and eastern green herons, the latter two of which nest on the refuge; and wood and white ibises.

Because of requests from wildlife lovers, naturalists, and others for permission to observe the unique wildlife of the area, access to the swamp is being allowed under permit. Nonsalaried, licensed guides conduct the visitors, thus preventing undue disturbance of the wildlife. Fishing, allowed only under permit and in restricted areas, has been unusually good. During a total of 5,606 man-days of fishing, 99,371 fishes were taken, principally perch, although a few bass, jackfish, catfish, and mudfish also were caught.

The fact that two or three Florida cranes, the wildest of wildlife, have become sufficiently unafraid to spend part of nearly every day within 50 yards of the canal through which boat traffic passes, eloquently shows what protection means to the wildlife of the swamp.

Supplementary regulations for the administration of the Okefenokee Refuge as approved in August were published in the series of Service and Regulatory Announcements (B. S. 89).

MEDICINE LAKE MIGRATORY WATERFOWL REFUGE, MONT.

Two full years of administration have seen the Medicine Lake Migratory Waterfowl Refuge, in Roosevelt and Sheridan Counties, Mont., change from a badly overgrazed and drought-stricken area to one in which newly created water-impoundment areas are within reasonable distance of the spill stage and where nesting cover has made a remarkable come-back. The spring run-off and summer rains have started the refuge well on its way to restoration.

Through the aid of the C. C. C. camp, which began work on the area May 21, 1937, and of W. P. A. labor, which has been utilized on the project since April 16, 1938, development has been outstanding; it includes the completion of a secondary headquarters building, construction of approximately 11 miles of refuge boundary, and 1 mile of inside fence, 20 acres of shelterbelt, and 90 acres of aquatic planting; construction of an overnight cabin and camp garage; riprapping of roads and dikes; and the building of 26 miles of roads and 29 miles of firebreaks. Widening the Muddy Creek diversion ditch entailed the excavation of about 47,550 cubic yards of earth. Lake and pond development, nest and brood studies, landscaping, general clean-up, the razing of undesirable structures, seed collection, and the construction of upland-game-bird shelters and feeders were other projects on which men from these two sources were engaged.

The refuge was a concentration point for numerous waterfowl during migration, particularly mallards, pintails, blue-winged teals, shovelers, redheads, ruddy

ducks, goldeneyes, and buffleheads. Goldeneyes, buffleheads, and redheads were present in much larger numbers than in 1937. A great many waterfowl nested, and broods of mallards, pintails, and blue-winged teals could be observed on all parts of the refuge. Gulls and terns bred on Gull Island, near the northeast corner of Medicine Lake, in such abundance that it was difficult to walk over the island without stepping on their eggs or young. Willets, avocets, and other shore birds also nested in abundance.

About 437 acres were planted to field crops for the use of the birds during the spring of 1938. Several hundred pounds of seeds and 1,200 tubers of aquatic plants, as well as some 78,000 trees and shrubs, also were planted.

During fall and early winter a number of upland-game-bird shelters were constructed of willow brush and marsh grass. Thirty-seven such shelters were placed at favorable locations over the refuge and supplied with self-feeders for use when natural food shortages or adverse weather conditions prevail. Pheasants and sharp-tailed grouse used these shelters and feeders extensively during the winter, but Hungarian partridges seemed to prefer to eat what they could find on the outside and except on one or two occasions did not enter the shelters. No noticeable losses occurred in any of the upland game birds during the winter.

Emergency grazing was permitted on the refuge for a month in the summer of 1937, during which time 89 cattle were carried on designated areas. A number of special-use permits were issued for cutting hay between August 1 and 15, and a total of 175 tons was harvested.

CAMAS MIGRATORY WATERFOWL REFUGE, IDAHO

The Camas Migratory Waterfowl Refuge, in Jefferson County, Idaho, is another of the Federal waterfowl sanctuaries placed under administration. Although a refuge manager was assigned to the area on August 1, it was not closed to hunting until October 8, when the Executive order establishing the refuge was issued. It is strategically situated on the important Snake River migration route and is an excellent nesting and resting place for ducks, coots, shore birds, and grebes.

Relatively few ducks stopped there during the fall, but at the height of the 1938 spring migration approximately 75,000 ducks, 300 Canada geese, and 400 whistling swans were noted. About 30,000 of the ducks were pintails and 20,000 mallards.

It was estimated that 10,000 ducks nested on the refuge in 1938, including mallards, gadwalls, baldpates, blue-winged and cinnamon teals, shovelers, pintails, redheads, canvasbacks, and ruddies. Coots, great blue and black-crowned night herons, American bitterns, white pelicans, long-billed curlews, avocets, willets, and killdeers also nested in numbers on the area.

About 40 antelope that ranged on the refuge until December returned in April. Their numbers will probably increase and they should eventually winter on the refuge. Pheasants were numerous during the fall, many remained all winter, and large numbers also nested. At least 600 sage hens were present until the first of December.

To get as much water as possible into existing sloughs and pot holes, necessary dikes were built, and these, together with a number of ditches, have produced excellent nesting conditions. The topography of the refuge is such that very little development is necessary to obtain almost ideal environment. A W. P. A. crew at work from December 1 to June 30 performed a variety of work, including the construction of 2 rock and earth diversion structures (with head gates), 75 small spill boxes, 50 ditch head gates, and 6 dikes (partially completed); cleaning out and repairing 13 miles of ditch and excavating 2 miles of new ditch; constructing 6 miles and graveling 1 mile of patrol road; peeling 2,100 fence posts; repairing 2,400 rods of fence; and razing 12 useless buildings. About 1,500 tons of hay were harvested and a maximum of 800 cattle were grazed on the refuge under special-use permits.

DELTA MIGRATORY WATERFOWL REFUGE, LA.

One of the Bureau's most important wintering sanctuaries for waterfowl is the Delta Migratory Waterfowl Refuge, in Plaquemines Parish, La., at the mouth of the Mississippi River, where almost a million ducks spent the past winter. An increase of at least 20 percent was noted in the numbers of wintering ducks, most common of which was the wigeon, closely followed by the pintail. Approximately 300,000 blue geese, 30,000 lesser snow geese, 5,000 Canada geese, and a few white-fronted and Hutchins's geese also wintered on the refuge. Food conditions

were excellent, and the geese remained all winter, to the exclusion of surrounding territory.

Among the other migrant birds noted on the refuge, most of them in great numbers, were greater and lesser yellowlegs, willets, and sandpipers. Gulls, terns, white pelicans, ibises, gallinules, ospreys, and coots also were common. Snowy and American egrets and six other species of herons remained all year in almost inestimable numbers.

An appreciable increase in all forms of wildlife on the refuge was noted, exceptional increments being observed in the populations of otters and white-tailed deer.

The use of W. P. A. labor was continued, with noteworthy results. Eight permanent buildings were completed, and other work, including repairs, painting, plumbing, roofing, and electrical wiring, was done on several others. Concrete walks and a splendid system of drainage ditches connecting with a large sump were constructed, and a levee was built around three sides of the headquarters site. Seven small boats, some now in use on other refuges, were constructed; and a number of wooden observation towers were built along the coast where needed. These towers have proved of great value both in the observation of wildlife and in the prevention of trespass. Ditches, bayous, and passes were cleaned out by the W. P. A. workers, thus opening them up to a steady flow of fresh clear water, which has effected a marked decrease in the growth of the troublesome alligatorweed.

BOMBAY HOOK MIGRATORY WATERFOWL REFUGE, DEL.

The Bombay Hook Migratory Waterfowl Refuge, in Kent County, Del., was established by Executive order of June 22, 1937. Before title to the lands was actually vested in the United States, however, with the approval of the former owners, it was possible to close the area to hunting during the season of 1936. As a consequence, waterfowl congregating on the refuge have received absolute protection for 2 years, and definite increases were noted this year in many species. During the height of the fall migration, an average of 36,000 ducks and 1,700 greater snow geese used the refuge; and a maximum of 25,000 ducks and 10,000 greater snow geese were noted during spring migration. Upland-game species, including rabbits, quails, pheasants, and doves, also showed great increases, not only because of the protection received, but also because of the mildness of the last two winters and the availability of natural food.

The natural salt marsh is attracting more and more breeding birds each year; and the fact that the area is so completely broken up by tidal streams reduces depredations to such an extent as greatly to increase the percentage of hatch. The shoveler, 8 broods of which were observed on the refuge in 1937 for the first time in its history, bred again this year, 18 broods being recorded. Other nesting ducks were the blue-winged teal, black duck, and mallard. Willets also nested on the refuge for the first time.

In the fall, a small group of W. P. A. laborers began work on the refuge, first devoting their time to improvements to facilitate transportation, since a large part of the development program planned will involve work in the marshes. Roads were graded and graveled, a dock was rebuilt, and a gunner's cabin converted into a patrol cabin. Five sets of undesirable farm buildings were razed, and a marine railway constructed. Late in the spring a C. C. C. camp was established on the refuge.

Four acres were prepared by C. C. C. and W. P. A. labor for lining out 53,775 seedlings to be transplanted to permanent locations next year. Fifty-two acres were planted to barley and rye, a part of which will be harvested for seed and feeding, and the remainder left standing for the birds. In addition, 38 acres were planted to corn.

During the year, 7,063 muskrats were taken under permits issued to trappers, and 120 tons of salt hay were removed.

MONTEZUMA MIGRATORY BIRD REFUGE, N. Y.

Although the Montezuma Migratory Bird Refuge, in Seneca, Wayne, and Cayuga Counties, N. Y., in the important Finger Lakes migratory-bird flyway, has been under administration less than a year, it is already proving its worth. During the fall migration the main duck concentration was of black ducks, but

a few mallards, teals, and wood ducks congregated in the sloughs. Great blue herons also were noted on the refuge at that time. During the winter, from 5,000 to 10,000 ducks, about 75 percent of which were canvasbacks and the rest lesser scaups, mallards, baldpates, teals, and mergansers, concentrated in the vicinity of the refuge and fed along the shallow coves, where there is an abundance of pondweeds. When the water development planned for the area is completed even larger numbers should be attracted. In the spring several whistling swans were observed in the vicinity of the refuge, the first, it is said, for 6 or 8 years.

The burned marsh areas, grown up with nightshade, goldenrod, smartweed, and various grasses, together with the upland within the refuge boundary, provided excellent food and cover for the pheasants, which were common. Forty or fifty deer were estimated to be on the area.

C. C. C. labor used on the refuge since October 1937 made great progress in development work, which included constructing levees, jetties, water-control structures, and a series of dikes to form lakes and ponds; fencing and marking boundaries; building roads and trails; razing undesirable buildings; and erecting headquarters buildings and a lookout tower. A total of 22,650 seedlings were received and lined out, to be planted later in permanent locations on this refuge or distributed to others as needed.

MOOSEHORN MIGRATORY BIRD REFUGE, MAINE

Established principally for the protection and preservation of the woodcock, the Moosehorn Migratory Bird Refuge, near the town of Calais, Washington County, Maine, was placed under administration. Observations made throughout the year of its wildlife disclosed that the principal species of waterfowl present were black ducks, ring-necked ducks, scaups, American and hooded mergansers, goldeneyes, and blue-winged teals. Black ducks, ring-necked ducks, and hooded mergansers nested. Woodcock were abundant breeders, and, with the freeze-up delayed, many remained until the latter part of December. Ruffed grouse, while scarce farther south in Maine, were abundant on the refuge; deer were numerous; and five black bears were reported.

Improvements were accomplished mainly by W. P. A. labor; beginning late in January, although the refuge was posted earlier by the refuge personnel. Work began with 36 men, but this quota was increased until at the end of the year 210 men were employed, principally in road, fire-line, and fence construction, deer-yard improvement, and general clean-up.

Two hundred and thirteen fishing permits were issued, and approximately 1,200 man-days were spent in fishing.

BITTER LAKES MIGRATORY WATERFOWL REFUGE, N. MEX.

The 21,524-acre Bitter Lakes Migratory Waterfowl Refuge, in the northern Pecos Valley, one of the most important winter concentration points for waterfowl in New Mexico, is one of the newer Federal refuges. In conjunction with the Carlsbad Refuge, 50 miles to the south, it will provide excellent resting and feeding facilities for waterfowl. In its original state it offered desirable feeding and resting areas, but it had also excellent possibilities for improvement. W. P. A. construction work began in December 1937, and though development has been under way for only 6 months, an enormous amount of work was accomplished. Approximately 13,100 lineal feet of ditch to conduct water on the area and 10,200 lineal feet of dikes to impound it were completed; 18,000 fence posts were cut, 12,000 of which were hauled to the refuge; 27 miles of boundary fence were built; and 9 miles of road partly completed. For the headquarters buildings, construction of which has been begun, approximately 17,000 adobe bricks were made by the W. P. A. workers. More than 15,000 seedlings of cover- and food-producing shrubs were planted. Bulrush transplanting was completed in some of the newly created ponds.

During the winter the refuge harbored approximately 7,000 ducks, including mallards, gadwalls, wigeons, lesser scaups, blue-winged, green-winged, and cinnamon teals, and shovelers, and several thousand geese also stopped for a few days to several weeks at various times during the fall and spring migrations. Scaled quail are common on the upland areas, although cover is at present limited, a result of years of overgrazing by cattle, sheep, and goats before the refuge was established.

BOULDER CANYON WILDLIFE REFUGE, ARIZ. AND NEV.

Development of the Boulder Canyon Wildlife Refuge, in Mohave County, Ariz., and Clark County, Nev., was begun after December 15, on which date arrangements were completed with the National Park Service for the services of 20 men from its C. C. C. camps at Kaolin, Nev. Early in spring, before the heavy migration started, five small feeding ponds were completed, covering an area of approximately 240 acres. Adjacent to these, 600 acres of abandoned wheatfields were flooded, thus providing excellent feeding grounds. Other work undertaken by the side camp and more or less completed included the construction of 3 miles of graveled road, clearing land preparatory to building a water-control structure, building dikes and a small diversion dam, and developing a 3-acre experimental aquatic food plot.

The number of waterfowl in the vicinity of the Boulder Canyon Refuge was the largest for many years. Outstanding among them were Canada geese, but large flocks of mallards, scaups, redheads, cinnamon teals, ruddy ducks, coots, grebes, and mergansers also were noted. Several species of waterfowl wintered on the refuge in fair numbers, principally Canada geese, mallards, scaups, redheads, and cinnamon teals. The upland-game-bird population consisted of Chinese pheasants and Gambel's quail, the latter nesting in fair abundance.

Since more water is now available, conditions are greatly improved for Nelson's bighorn sheep, which occur both on the refuge and in the surrounding ranges, it having been estimated that at least 100 were present during the year.

The fishing season on the Nevada side of the refuge was closed during part of the year, but on the Arizona side State laws permitted fishing throughout the year. Catfish and bass are the principal game fishes; and bass weighing as much as 7 pounds were caught.

SACRAMENTO MIGRATORY WATERFOWL REFUGE, CALIF.

The Sacramento Migratory Waterfowl Refuge, situated in the Sacramento Valley, in Glenn and Colusa Counties, Calif., and established by Executive order of February 27, 1937, consists primarily of the old Spaulding ranch, which was formerly used for rice farming and livestock grazing. It is now an important wintering sanctuary for migratory waterfowl, particularly geese, six species of which were observed there, in the order of abundance, as follows: Lesser snow (31,200), cackling (31,000), Hutchins's (30,000), white-fronted (22,800), Canada (3,000), and Ross's geese (100). Pintails were the chief wintering ducks, followed by cinnamon teals, baldpates, mallards, green-winged teals, and shovelers. Early fall rains made conditions ideal for waterfowl: green food was available for the geese, and the ponds were kept fresh for the ducks.

Chinese pheasants, valley quail, mourning doves, and band-tailed pigeons were the upland game birds noted. The pheasants, of which 3,250 were estimated to be on the refuge, made extensive use of the food patches planted for waterfowl. Many shore birds frequented the area, and several species nested in large numbers.

The C. C. C. camp, assigned on May 15, 1937, continued development work, making the area more attractive to wildlife and easier to administer. Among the accomplishments were completion of 9 water-control structures and 1,933 rods of fence, graveling of almost 13 miles of roads, construction of dikes involving the use of 173,299 cubic yards of material, cleaning channels, planting 40 acres to winter grain for the birds and 300 acres to crops, and planting 2 old ponds on the refuge with pondweed, millet, rice, and prairie bulrush.

ARANSAS MIGRATORY WATERFOWL REFUGE, TEX.

Title to the major tract (approximately 46,000 acres) on the Aransas Migratory Waterfowl Refuge, in Aransas and Refugio Counties, Tex., was taken in December 1937. Acquisition of this area makes a most important addition to the refuge system, as it is advantageously situated in the great Texas Gulf coast wintering area for waterfowl. For a number of years the former owners had restricted hunting and trespass, and as a result the area has been extensively used by upland game species as well as waterfowl. Since regular

refuge personnel has not yet been assigned, detailed information is lacking as to waterfowl use of the area during the past winter. The reconnaissance studies, which were the basis for the acquisition of the area, however, adequately reveal its importance as a winter resort for migratory waterfowl.

In addition to supporting a large population of wintering ducks and geese, the refuge, because of its relative isolation, is one of the wintering places of the rare whooping crane, four of which were observed. Summer residents among the interesting species include the roseate spoonbill, great and little blue herons, Louisiana heron, snowy, American, and reddish egrets, black-crowned night heron, wood ibis, and mottled duck. The refuge also supports a varied population of mammals, including approximately 2,500 white-tailed deer, a few white-collared peccaries, and large numbers of raccoons, opossums, and armadillos. About 100 wild turkeys and large numbers of bobwhites also inhabit the area. The extensive thickets of live oaks, wild grapes, dewberries, and other plants produce almost unlimited food for these upland game species.

Before the refuge was established, large numbers of domestic hogs were permitted to roam over the area, to utilize the annual mast crop. Immediately after title was acquired, trapping operations were begun to eliminate these animals, not only to preserve the mast for the upland game but also to halt depredations on ground-nesting birds.

Most of the time of a small crew of W. P. A. workers assigned to the refuge in April has been spent in reconditioning truck trails needed for later development work, and in June construction was begun on camp buildings to be occupied by a C. C. C. company in October.

BIG-GAME PRESERVES AND RANGES

IMPROVED CONDITIONS

The herds of big-game animals on the preserves and ranges administered by the Biological Survey are benefiting by greatly improved grazing conditions. An abundance of moisture at the Charles Sheldon Antelope Refuge and Range, Nev., and the Wichita Mountains Wildlife Refuge, Okla., has resulted in the finest growth of forage in years. Elimination of domestic livestock from the Wichita Refuge has contributed largely to the improved condition of its ranges, and all of the many lakes in its 20,000-acre recreational area were filled by rains. At the Charles Sheldon Refuge all the dry lakes and reservoirs were filled, and all the springs now supply an abundance of water for the roving antelope, deer, and other wildlife.

At the National Bison Range, Mont., abundant rain has caused a fine growth of grass, and the range is recovering from the severe damage caused by the drought and grasshopper infestations of previous years. At the Fort Niobrara Game Preserve, Nebr., there was twice as much spring rainfall as last year, resulting in greatly improved forage conditions. While dry weather still prevailed in the section of the Sullys Hill Game Preserve, N. Dak., there has been enough moisture to keep the vegetation growing, and at the end of the year there was plenty of grass for the animals.

The buffalo herds on the four fenced preserves have increased satisfactorily, as have the Texas longhorns on the Wichita Refuge and on the Fort Niobrara Preserve. Installation of an adequate scale at the Wichita Refuge made it possible for the first time to weigh some of the longhorns, and two of the largest steers, each about 10 years old, weighed 2,045 and 2,035 pounds, respectively.

In order to keep the big-game herds at optimum size, to prevent overgrazing of the pastures, and to avoid resort to excessive winter feeding, the usual practice of disposing of the annual surplus was followed. In all, 259 buffalo, 215 elk, and 58 mule deer were removed from the herds, but as many of these as possible were used for breeding, restocking, and exhibition purposes.

The growing number of visitors indicates a wide interest in big-game preserves. With the aid of W. P. A. workers and employees of the C. C. C. camps much has been accomplished in improving the preserves by the construction of roads, trails, dams, and water-storage units, as well as buildings for personnel and equipment. Extensive recreational use of the Wichita Refuge—camping, swimming, fishing, and picnicking—attracted more than a quarter of a million people.

Two mimeographed leaflets on big-game preserves were issued, entitled "Preserves and Ranges Maintained for Buffalo and Other Big Game" (BS–95); and "Fort Niobrara Game Preserve, Nebraska" (BS–109). The numbers of animals on fenced preserves maintained by the Survey are shown in table 7.

TABLE 7.—*Animals on fenced big-game preserves maintained by the Bureau of Biological Survey*[1]

Preserve	Buffalo	Elk[2]	Antelope	Bighorn sheep	Deer		Total[3]	Young born in calendar year 1937[4]	
					Whitetail	Mule[2]		Buffalo	Bighorn sheep
National Bison Range, Mont.	340	22	-------	48	[2] 23	109	542	83	8
Fort Niobrara Game Preserve, Nebr.[5]	134	27	-------	-------	7	5	173	30	-------
Sullys Hill Game Preserve, N. Dak.	22	33	-------	-------	[2] 12	-------	67	6	-------
Wichita Mountains Wildlife Refuge, Okla.[5]	345	204	15	-------	[2] 773	-------	1,337	53	-------
Total	841	286	15	48	[2] 815	114	2,119	172	8

[1] With the exception of those of young born, figures are for June 30, 1938. No antelope were born on these preserves during the calendar year.
[2] Estimated.
[3] Including estimates.
[4] Young of elk and deer omitted, as in most cases only estimates could be made, but during the calendar year approximately 70 elk calves, 15 fawns of mule deer, and 60 of white-tailed deer were counted on these preserves.
[5] There are also 132 Texas longhorns on the Wichita Mountains Refuge and 14 on the Fort Niobrara preserve, including 26 calves of 1938, 4 of which are in the herd at Fort Niobrara.

ELK REFUGE, WYO.

Numerous visitors from various parts of Wyoming and adjacent States were able to see the elk concentrated on their winter feeding grounds on the Elk Refuge, Wyo., when the State Highway Department undertook during the winter to keep open the road that leads in from the nearby town of Jackson.

An unusual winter followed a heavy rain in December that melted much of the snow on the meadowlands; alternate storms and thawing and freezing in January formed a heavy layer of ice over most of the refuge, thus depriving the animals of much of the forage growth normally accessible to them. Early in February the feed that had not become frozen down had been grazed fairly close and the elk began leaving. This made it necessary to begin feeding on February 12, and one band of about 3,000 elk was fed on the meadows so close to the road that visitors had excellent opportunity to view them. Many persons also were taken around the feeding grounds on sleighs used to carry the hay. If the great display of interest results in the roads being kept open in the future, the Elk Refuge will become one of the principal winter attractions for the public in that section.

Records kept during the hunting season in 1937, when checking stations were maintained by the Forest Service and the State Game Department, show 3,219 elk taken. While no information is available as to the number killed by local hunters, it is believed that approximately 400 were so taken, bringing the total kill during the season to some 3,600.

A census of the elk in the Jackson Hole herd taken in cooperation with the State Game Commission and the Forest Service during March showed a total of 6,206 on the three feeding grounds and 1,576 wintering on adjacent areas outside. The elk inside were counted by men on the ground, while those wintering outside were counted from an airplane. Thirty hours' flying time was required to complete the count, which showed a total of 17,370 elk in the herd.

Among the elk concentrated on the feeding grounds there was a loss of 158—120 calves, 27 cows, and 11 bulls. Based on the airplane count, it was estimated that there was a winter loss of about 15 percent in the upper Gros Ventre Valley, or some 600 head, of which about three-fourths were calves. An unusually severe blizzard late in March contributed materially to these losses.

Feeding operations ended on April 16, and during the 64 days of feeding the elk consumed approximately 1,700 tons of hay. More than 1,600 tons was harvested on the refuge during the summer of 1937, and approximately 4,000 tons was carried over from the previous winter. To prevent loss through deterioration, 1,220 tons of surplus hay was sold to nearby ranchers, and 616 tons of baled hay was shipped to the National Bison Range, Mont., for feeding

the buffalo herd. After feeding operations were concluded there remained at the refuge about 1,475 tons of hay and 130 tons of cottonseed cake for next winter, to which will be added the 1938 harvest.

The elk were slow in leaving the refuge, as the snow did not melt farther north until late in May. Approximately 1,000 were driven from the refuge meadowlands north across the Gros Ventre River the latter part of May toward their summer range, but a few were still left on the refuge late in June, having drifted in from nearby foothills.

Seventeen mule deer ranged on the butte in the refuge during the early spring, and about 30 of these animals wintered in the northwest section of the refuge. Forty bighorn sheep wintered near the western boundary, and late in March seven moose were seen in the Gros Ventre River bottoms in the refuge. Fewer waterfowl were on the refuge during the fall migration than in the previous year, as many birds visiting the valley remained nearer the grainfields in which they feed. Hunters reported a larger number of Canada geese in areas along the Snake River than for several years. Fifty-two sage grouse were observed on the refuge. Coyotes were more numerous than ever during the winter but did little if any damage to the elk.

Improvements at the refuge included the roofing of eight hay sheds previously framed, and the construction of 1¼ miles of telephone line. W. P. A. workers, under the supervision of a regular Bureau employee, built three two-room cabins for housing men handling irrigation work. A gas and oil house was built, a dwelling on a recently acquired tract was repaired and remodeled, 250 logs were hauled in for use in constructing a new headquarters building, 540 rods of buck-and-pole fence was built, 1,600 rods of pole fencing removed from interior tracts, and 16 miles of the boundary line posted.

HART MOUNTAIN ANTELOPE REFUGE, OREG.

More forage than usual remained on the Hart Mountain Antelope Refuge, Oreg., at the end of the summer, and during the fall and winter unusually heavy snows and rains produced an abundance of water. The 3 months January to March brought the most snow and the greatest rainfall that has been recorded in this locality in more than 20 years. This produced a very satisfactory range condition, and it is hoped it heralds the return of wet years.

Delayed warm weather made all the grasses and plants slow to start, but their later growth and restoration, even on depleted areas, has been remarkable. Full advantage will be derived from the seeding of the present satisfactory cover, since grazing by domestic stock has been substantially curtailed.

The antelope reappeared on the refuge on April 7 and, with exceptionally favorable conditions and nearly total absence of livestock, have been more widely distributed over the tablelands than for many years. There was a marked tendency of the more venturesome animals to follow the receding snow lines to the hills and mountains. Wide distribution was a factor in preventing the sighting of numbers of fawns until early in June, but by the middle of the month they were seen traveling with their mothers when the does were disturbed. Not only the antelope but the mule deer appear to be in uniformly good condition.

Absence of domestic sheep from the refuge during the last half of the year reduced the ordinary food of predators and appears to have lessened their abundance. Some coyote dens were destroyed on the refuge, and other control operations continued.

Sage grouse were not greatly in evidence at the close of the year, and while broods of four to nine were seen throughout June, they were not yet able to fly readily, so that accurate counts were impossible. Moisture and food conditions were excellent for their summer development. At the end of the year ducks, mainly pintails and teals, were present on all the lakes.

Development work included the improvement of 79 miles of desert-type roads by the removal of high centers and loose rocks, and improvement or rebuilding of approximately 25 miles of other roads. In addition, 4 miles of travel ways were made through the rocks, a small bridge was rebuilt, dams were replaced in several channels of a creek, and fences were repaired. The establishment of a C. C. C. camp made possible the inauguration of an improvement program that includes the construction of administration buildings and the development of water-control structures, springs, roads, and trails.

DESERT GAME RANGE, NEV.

The Desert Game Range, Nev., embracing 2,022,000 acres, established by Executive order of May 20, 1936, primarily for the conservation of Nelson's bighorn sheep, was placed under administration, during the year. An old cabin was put in condition to serve as quarters for the superintendent until better accommodations can be provided. This is one of the areas administered jointly by the Biological Survey and the Grazing Division of the Department of the Interior in connection with the organization of grazing districts for livestock under the Taylor Grazing Act of 1934.

The large bands of bighorns that in former years frequented the high desert ranges have been greatly reduced by various causes so that they have just about held their own in some sections and in others have become extinct. Small bands of 4 to 12 have been seen on various parts of the range, and while it has not yet been possible to compile a satisfactory census of the whole area, the range is being extensively patrolled with this in view. Springs are being systematically located and studied for future development and for the conservation of the scant supply of water in this extremely arid section. Careful observations are also being made of the feeding habits, forage plants, lambing beds, presence and effect of predators, and other factors bearing on the welfare and upbuilding of the animals on the refuge.

Through the cooperation of the Forest Service and sportsmen of Clark County, Nev., 20 antelope fawns were received on June 15, from the Charles Sheldon Antelope Refuge, Nev., where they had been picked up on the refuge soon after birth and raised on the bottle. It is hoped that these may form the nucleus for reestablishing antelope on this range.

ADMINISTRATION OF WILDLIFE-CONSERVATION LAWS

Federal statutes administered by the Bureau of Biological Survey for the conservation and restoration of wildlife are as follows: The Lacey Act of 1900, as amended June 15, 1935, regulating shipments interstate and in foreign commerce of wild animals, their dead bodies, or parts thereof, and the importation of live birds and mammals from foreign countries; the Migratory Bird Treaty Act of 1918, protecting birds that migrate between the United States and Canada, as amended June 26, 1936, to extend its provisions to the treaty concluded March 15, 1937, protecting birds that migrate between the United States and Mexico and regulating the movement of game mammals and parts thereof between the two countries; the Migratory Bird Conservation Act of 1929, authorizing the establishment of bird refuges; the Migratory Bird Hunting Stamp Act of 1934, as amended June 15, 1935, to aid in refuge establishment; the Federal Aid to States in Wildlife Restoration Act of 1937; a law (sec. 84, Criminal Code) protecting wildlife and property on national wildlife refuges; and, through the Alaska Game Commission, the Alaska Game Law of 1925, as amended June 25, 1938.

To make the text of these laws readily available to Federal and State law-enforcement officers, legislative committees, conservationists, and others interested, a compilation was published in the series of Service and Regulatory Announcements (B. S. 87), and various regulations thereunder separately.

REGULATORY ACTION

The Migratory Bird Treaty Act regulations were amended in 1937 to include the migratory birds embraced in the Mexican convention additional to those covered by the treaty with Great Britain and also to include certain game mammals and make provision for their transportation to and from Mexico. These regulations provided an open season on migratory waterfowl of 30 consecutive shooting days in each of three transcontinental zones, beginning in the northern zone on October 9, in the intermediate zone on November 1, and in the southern zone on November 27. Full protection was continued on canvasback, redhead, wood, ruddy, and bufflehead ducks, Ross's goose, and swans throughout the country, and on the snow goose and brant in the States bordering on the Atlantic Ocean.

The restrictions on taking waterfowl by means of bait or by the use of live decoys, and the three-shell limit on repeating shotguns also remained in effect. The hours for shooting waterfowl and coots were from 7 a. m. to 4 p. m. Wil

son's snipe, rails and gallinules (other than coot), woodcock, mourning doves, white-winged doves, and band-tailed pigeons were permitted to be taken from 7 a. m. to sunset. The daily bag and possession limits on ducks remained unchanged, but on geese and brant the number permitted to be taken and possessed was increased from four to five. The limits on rails and gallinules remained unchanged except that for the sora, which was reduced from 25 to 15, and that on coots, increased from 15 to 25. The limit for Wilson's snipe, or jacksnipe, remained at 15 and for the woodcock at 4. The bag limit on mourning doves was reduced from 20 to 15. White-winged doves were added to the federally protected game birds and for these and mourning doves the limit was fixed at 15 in the aggregate of both kinds. Band-tailed pigeons remained in their previous status, with a maximum bag of 10. The interstate shipment of migratory game birds remained restricted to not more than 1 day's bag in a calendar week.

The regulations for 1937[2] were published in the series of Service and Regulatory Announcements (B. S. 88), and the open-season dates and other information regarding hunting were shown on a poster (No. 60–Bi). A migratory-waterfowl hunting-stamp poster (No. 59–Bi) also was issued. Other publications relating to conservation laws included a mimeographed abstract of State fur laws affecting trapping seasons, possession, and the sale and shipment of pelts (Leaflet B. S. 97); and the annual directory of Federal, State, and Canadian game-protection officials (Miscellaneous Publication No. 276). At the close of the year there was in press the annual volume of the Department's Agricultural Statistics, 1938, containing tables (625 and 626) of hunter's licenses issued by States, with total money returns for the seasons 1935 and 1936, and sales of migratory-bird hunting stamps for the years 1934–36. Many press statements on wildlife-conservation subjects were issued for educational purposes and also to advise the public of the results of law enforcement as well as of changes in the regulations. Amendments to the regulations under the Alaska Game Law were published in Alaska Game Commission Circular No. 14.

According to a plan, advanced by the Survey, and already endorsed by a majority of the State commissioners, representatives of the States will meet annually with officials of the Bureau to discuss conditions affecting migratory game birds and their pursuit by hunters. The State leaders met with members of the Biological Survey in June and were a great aid in preparing the draft of the hunting regulations for the 1938 season.

WORK OF GAME-MANAGEMENT AGENTS

Working under central direction and the general supervision of regional directors, 41 game-management agents covered the entire country in enforcing Federal game laws in assigned districts and were aided by 19 deputy agents, who were given seasonal employment of about 6 months each. The agents spent most of their time patrolling important waterfowl-concentration areas where game is likely to be taken illegally, and arrangements were made for the deputy agents to be readily available to investigate reported violations. More than 6,500,000 game-license holders (1,500,000 of whom are potential waterfowl hunters), the several State game departments, and millions of citizens interested in birds and other wild animals look to the Biological Survey for leadership in the enforcement of game laws and wildlife protection.

A VARIED AND HAZARDOUS TASK

The wildlife resource of this country, of inestimable value, may be preserved and enjoyed only as it is protected. The game-management agents are actively engaged in furnishing this protection and in conducting educational programs in conservation. In this latter work they write for newspapers and talk before schools and sportsmen's clubs and over the radio. When citizens in a community complain of damage to crops by game, these agents are available to verify the reports. When beavers become destructive to dikes and drainage ditches, the agents are called upon for advice and assistance in capturing and transplanting them to headwaters of streams where they become water conservators and are preserved as valuable fur animals.

[2] Regulations for the season 1938, adopted by the Secretary after the close of the fiscal year, were approved and proclaimed by the President on July 16, 1938 (3 F. R. 1766: S. R. A.–B. S. 92).

Each winter the game-management agents join with other Bureau employees and a host of cooperators in the annual waterfowl census. Each summer the agents carefully cover their respective districts to ascertain the relative abundance of nesting migratory birds and the success of the spring hatch. When called upon, some of the agents journey to the great waterfowl breeding areas of the Canadian Provinces to carry on these investigations, which are of material assistance to the Bureau in recommending regulations for the hunting of migratory birds.

Outrunning violators, rowing boats, swimming rivers, wading marshes, and being liable to exposure and physical encounter and other risks, including assaults, accidental shooting, and failure of equipment, are not uncommon incidents in the work of the agents and make it necessary that they be alert mentally as well as physically. Tact and understanding of local conditions and a fair-minded approach to all problems confronting the men also are essential qualifications. In the hunting season they may follow the migrations of birds from Canada to Mexico, and each year they travel on the average about 30,000 miles, by car or train, on horseback, on foot, in boats, and on snowshoes, and even use airplanes to apprehend violators when necessary. A few instances of the hazards faced by game-management agents, occurring during the year may be cited:

On February 26, 1938, two deputy agents apprehended three men violating game laws on a Federal refuge at midnight. Preceding the arrest there was a struggle in which a deputy shot one of the violators in the shoulder after this man had cut a severe gash in a fellow deputy's head and threatened to kill him rather than submit to arrest.

Deputy Agent Delbert Hubbard died at Poplar Bluff, Mo., on January 11, 1938, of an accidental gunshot wound, received while pursuing law violators.

On November 21, 1938, a deputy on patrol duty with a State investigator in Illinois found three men unlawfully hunting waterfowl and seized their ducks and guns. Later in the day the three men, temporarily released, and accompanied by a fourth, accosted the officers, and while the fourth man trained a shotgun on them, the other three obtained their confiscated property. Later on, however, the guns and ducks were recovered, the violators were tried and sentenced to jail for resisting Federal officers.

COOPERATION WITH STATES

That the cooperative relations between State officers and the Survey's law-enforcement personnel are effective may be noted in the following record:

The Bureau's agents furnished information in 1,637 cases brought into State courts involving violations other than illegal transactions in furs. These cases, prosecuted in the courts of 40 States, resulted in 39 jail sentences and fines to the amount of $45,972.

Game officials in 35 States were furnished records by Survey agents of 4,190 possible illegal transactions in furs, and as a result 141 cases in State courts were closed by fines and costs totaling $3,106, and 1 jail sentence of 30 days was imposed.

APPREHENSION OF VIOLATORS

The activities of the Federal agents are exemplified in the following apprehensions:

In a drive against the sale of game, a large number of ducks were seized in a Texas night club, the proprietor of which had been making a market for thousands of waterfowl and other game hunted in and out of season. In March the club proprietor was sentenced to 13 months in Leavenworth Penitentiary, on the charge of conspiracy to violate the Migratory Bird Treaty Act. A number of his market gunners also received jail sentences. The club catered to a wealthy clientele, and 23 persons who were buying the illegal offerings were fined in State court sums aggregating $1,315. State game wardens aided Federal agents in these cases.

In another drive to break up commercializing game in an area in Arkansas, Mississippi, and Tennessee within 100 miles of Memphis, Tenn., Federal agents apprehended 52 persons for alleged illegal slaughter, interstate transportation, and sale of wild ducks, quail, and woodcock. Evidence obtained included more than 3,000 illegally possessed waterfowl and other game birds. Most of the

market gunners were old offenders and had been hunting the marshes and quail ranges of the three States and selling their bags to individuals, restaurants, hotels, and night clubs. Evidence against them was obtained by more than 18 months of undercover work. The 52 persons arrested were arraigned before United States commissioners and in State courts in the three States. Some of the minor cases, prosecuted against 18 men and 2 women, resulted in fines and costs totaling $1,065. In addition, the courts suspended three 60-day jail sentences and $125 in fines. Three of the offenders are serving time in jail in lieu of payment. In Mississippi and Arkansas, 32 of the men brought before United States commissioners were placed under bonds totaling $21,850, to appear for trial in Federal courts for violations of the Migratory Bird Treaty and Lacey Acts. Not all these cases had come to trial at the close of the fiscal year. State game agents aided in the last stages of this drive, and when the undercover work was in progress very material assistance was received from the Tri-State Game and Fish Association and the American Wildlife Institute.

A fur trader operating in Idaho and Nevada and selling his furs in New York City was fined $500 and sentenced to a year and a day in a Federal penitentiary last March for unlawful transportation of 362 beaver pelts. He was convicted of conspiracy to violate the Lacey Act. This man made a market for the pelts of beavers trapped in Idaho, which were shipped by truck into Nevada and from there sent to New York City for sale. The arrest of the head of the ring dealing illegally in furs broke up this racket.

Three men charged with illegally importing Canadian silver fox furs into New York City received punishment in Federal court, and 48 skins, as well as two automobiles used in transporting them, were seized. The men had been smuggling furs from Canada into this country for several years. Customs officials and New York detectives aided in this case.

During a 3-month period more than 500 wild-duck traps were destroyed on Maryland and Virginia marshes in an effort to stamp out the illegal practice of trapping and marketing waterfowl. Most of the ducks trapped in this section are bought by "duck bootleggers" who in turn sell them in large eastern cities. Hundreds of ducks—mostly pintails, mallards, and black ducks--were liberated from the traps after being banded by the agents for further study of their migratory habits. Progress is being made in breaking up the practice of trapping ducks, but much still remains to be done. The cooperation of sportsmen, State game and police officials, and others has helped the Federal agents greatly in this work.

Of the 669 new cases filed in Federal courts, 343 were disposed of, resulting in 280 convictions. That more than 81 percent of the prosecutions in new cases thus filed and disposed of resulted in convictions indicates that the agents are neither prosecuting people needlessly nor making useless arrests.

In the enforcement activities 41 game-management agents and 19 deputies gathered information in cooperation with State officers, supplemented evidence, or furnished all the evidence themselves in a total of 2,443 game-law violation cases brought into State and Federal courts.

VIOLATIONS AND PENALTIES IMPOSED

MIGRATORY BIRD TREATY ACT CASES

An increase of 59 cases over the preceding year reported for Federal prosecution, an increase in the number of convictions obtained, and a slight decrease in cases disposed of is shown in table 8. In 137 violations, prosecution was not recommended because of lack of evidence, youthfulness of accused, or other satisfactory reasons. Fines ranging from $1 to $500 and costs, aggregating $12,456, were imposed in Federal courts; and in 22 cases, fines aggregating $969 were suspended. Jail sentences were as follows: 1 day (8), 4 days (3), 10 days (3), 20 days (3), 30 days (12), 40 days (1), 60 days (4), 73 days (1), 90 days (1), 120 days (1), 6 months (1), 13 months (1, penitentiary). Suspended jail sentences were as follows: 16 days (1), 30 days (4), 60 days (2), 90 days (3), 4 months (4), 6 months (5), 1 year (1), 13 months (2). Probation terms were as follows: 30 days (4), 4 months (1), 6 months (9), 8 months (3), 10 months (3), 18 months (1), 1 year (12), 2 years (8), 3 years (2), 5 years (8).

TABLE 8.—*Cases of violation of the Migratory Bird Treaty Act disposed of during the fiscal year and cases still pending on June 30, 1938*

Disposed of	Number	Pending	Number
Convictions	576	From former year	324
Dismissals	68	New cases	669
Nol-prossed	16		
Jury trial not guilty	24	Total	993
Closed without prosecution	38	Disposed of	730
No bill	5		
Closed by death	3	Pending at end of year	263
Total	730		

The following court sentences are noteworthy:

Purchasing and selling wild ducks: Texas (1), 13 months in Leavenworth Penitentiary. Unlawfully killing and selling ducks (2), 13 months each in Leavenworth, suspended for 3 years. Selling ducks: Michigan (1), 60 days at Milan Federal Prison; Arkansas (3), $100 fine each; Louisiana (1), 60 days in jail and 5 years on probation. Purchasing ducks: Michigan (1), $130 fine.

Exceeding possession limit on ducks: California (1), $300 fine and 60-day jail sentence.

Hunting ducks by means of bait and live decoys: Illinois (10), $135 fine each. By bait, Arkansas (3), $50 fine each.

Trapping wild ducks: Maryland (1), $500 fine.

Using motorboat to rally and stir up ducks: Ohio (2), one, $329.50 fine and suspended jail sentence of 3 months; the other, $100 fine and jail sentence of 3 months.

Killing and possessing ducks in close season: Texas (1), $250 fine and 2 years' probation; Illinois (1), 30 days in jail. Possessing ducks in close season: Louisiana (1), 6 months in jail and (1), 30 days in jail. Possessing redhead ducks: Michigan (1), $100 fine and 4 months in jail.

Killing a swan: Wisconsin (1), $100 fine.

Killing geese in close season: Washington (1), $100 fine; Texas (1), 73 days in jail.

Hunting game birds with unplugged gun and after 4 p. m.: Michigan (2), $150 fine each.

Hunting waterfowl without a duck stamp: Michigan (1), 60-day jail sentence suspended on probation 2 years.

Hunting doves with unplugged gun: Texas (1), $50 fine; Kentucky (2), $50 fine each; Georgia (4), 30-day jail sentence each. Killing doves over bait: Tennessee (1), $224 fine.

Shipping live quail interstate: Alabama (2), jury trial, $100 fine, and 60 days each in jail.

Hunting and possessing Hudsonian curlew: California (2), one, $200 fine; the other $100 fine and 2 years on probation.

Trapping painted buntings: Louisiana (4), 4 months' jail sentences suspended and probation for 5 years. Selling buntings (1) 30 days in jail.

MIGRATORY BIRD CONSERVATION ACT CASES

For violations of the Migratory Bird Conservation Act, 11 new cases were submitted, 3 were pending from the previous year, and 10 were closed as follows: $25 fine (1); $10 fine (2); probation for 6 months (4); probation for 2 years (1); jail sentences of 30 days (2); leaving 4 cases pending.

MIGRATORY BIRD HUNTING STAMP ACT CASES

New cases submitted for violations of the Migratory Bird Hunting Stamp Act totaled 74. Of this year's pending and new cases, 76 were successfully concluded, the fines ranging from $1 to $25 and aggregating $339.50. In addition two fines of $25 each were suspended. Other cases were disposed of as follows: Nol-prossed, 4; dismissed, 12; closed without prosecution, 3; closed by death, 1; no bill found, 1; verdict of not guilty, 3. Sentences were as follows: 1 day (1); 60 days (1) suspended for 2 years; probation 1 year (2); 2 years (2); 6 months (1); 2 months (1). Cases still pending, 45. It is significant to note that more than 780,000 hunters and others purchased these $1 stamps, and the returns exceeded the $635,001 realized from the first-year sales (of 1935) by about 23 percent.

WILDLIFE REFUGE TRESPASS CASES

Under the law protecting wildlife and Government property on national wildlife refuges, 32 new cases were reported and 3 were pending from the previous year. Of the 35, 14 were closed, 1 in Arkansas, 1 in Delaware, 2 in Nevada, 6 in Montana, and 1 in California, by fines aggregating $142, and 3 in California,

where the defendants were placed on probation for 6 months. Cases still pending, 21.

LACEY ACT CASES

Eleven new cases of illegal interstate shipment were reported for prosecution in the following States: Nevada (4), of beavers to New York; Michigan (1), illegal transportation of deer to Wisconsin; Texas (1), transporting interstate bighorn sheep illegally taken in Wyoming; Missouri (4), transporting illegal beaver skins from Illinois; California (1), mismarking beavers and muskrats shipped to St. Louis. Of these new cases, nine were disposed of as follows: California (1), $50 fine; Missouri (1), $100, (1), $50 fine, (2), dismissed; Texas (1), $200 fine (suspended for 5 years); Michigan (1), 6 months in jail (suspended on 2 years' probation); Nevada (1), a year and a day at McNeil Island and a $500 fine, (1), dismissed due to spending 4½ months in jail prior to arraignment. Previously pending cases were disposed of by the following fines: Missouri, illegal transportation of beavers from Colorado to St. Louis (1), $300, (1), $100, (1), $50; Ohio, illegally transporting a deer from Michigan (1), $100 and costs; Montana, illegal transportation of deer from Wyoming (2), dismissed.

The Federal courts ordered forfeitures as follows: 91 beaver skins, 2 muskrat pelts, and 2 heads and 1 skin of bighorn sheep.

Agents operating under this statute discovered information relating to possible infractions of State game laws as a result of inspections at fur-receiving centers in 18 States. Invoices relating to 4,190 shipments of skins of fur animals were sent to game-protection officials in 35 States, Alaska, and Canada, and of the 1,853 returns received all were legal or did not merit action except 141, and in these cases fines and costs aggregating $3,106 were collected, and one 30-day jail sentence was imposed.

Evidence regarding 1,637 cases involving violations other than illegal interstate shipments of skins of fur animals were handled in 40 States, where fines and costs imposed by State courts aggregated $45,972 and 39 jail sentences of 5 to 90 days aggregated 1,068 days. In 34 of the remaining cases suspended jail sentences of 5 days to 1 year were imposed, aggregating 1,666 days. In eight cases juries returned verdicts of not guilty, and in eight others the defendants were adjudged not guilty. In 12 cases defendants were placed on probation, and 66 cases were dismissed.

UPPER MISSISSIPPI RIVER REFUGE CASES

Of 8 cases pending from previous years and 12 new cases reported for prosecution, 12 were closed as follows: Nol-prossed (1); no bill (2); 30 days in jail (2); $50 fine (1), $25 (1), $10 (3); 6 months' probation (1), 1 year probation (1); leaving 8 still pending.

Based on information obtained by refuge protectors involving State game-law offenses, 23 cases were successfully closed in State courts, 15 of these by fines and costs aggregating $343, and 8 by jail sentences, as follows: 10 days (1), 15 days (1), 30 days (2), 60 days (1), and 90 days (3).

COURT ACTION ON BAITING CASES

The Circuit Court of Appeals for the Seventh Circuit (Illinois) affirmed the action of the Federal court for the Southern District of Illinois, which had imposed a fine of $200 and costs on two defendants charged with taking migratory waterfowl by means of feed or bait. The United States Supreme Court denied the applications for writs of certiorari in these cases.

A case from the Southern District of California wherein it was contended the Migratory Bird Treaty did not authorize Congress to give the Secretary of Agriculture power to regulate the means by which migratory birds could be taken and in which the lower court decided in favor of the Government was appealed to the Circuit Court of Appeals for the Ninth Circuit (California). The appeals tribunal sustained the action of the lower court and in the course of its opinion stated:

> We do not agree * * * that bringing the line of flight of wild fowl by baiting to a hunting territory is not indirectly a luring within the meaning of the regulation.
>
> We believe the appellants have violated the Secretary's regulation whether by pursuing the indirect method of baiting before the season opens to keep the birds there to be shot after the season opens, so that hunters may flush them as they walk or punt over the

preserves, or by directly placing the grain in front of the blinds or stands during the season. Wherever the grain is placed on the preserves, the wind will create lines of the birds' flight, to and from it, which will aid the slaughter from blinds located for the purpose.

The court further held, in referring to the regulation not permitting the taking of migratory game birds by means of feed, that the act and regulation are supported by the treaty, that making the regulation against baiting is not a delegation of legislative power, and that it does not lack the definiteness necessary to describe a penal offense.

IMPORTATION AND OTHER PERMITS ISSUED

FOREIGN SPECIES EXCLUDED

Several unsuccessful efforts were made to import skylarks, common and crested mynas, greenfinches, and chaffinches, excluded from this country by joint action of the Secretary of Agriculture and the Secretary of the Treasury pursuant to the Lacey Act of May 25, 1900, since which date no forbidden species of bird or mammal has established a foothold in the United States.

One mongoose arrived at the port of New York, N. Y., in May, from Naples, Italy, but was intercepted by the Survey's inspector at that port and refused entry. The importer had the mongoose in a specially constructed handbag, with wired ventilation openings, and declared it as a squirrel. The animal was seized and placed in the custody of the chief purser of the steamer for deportation.

Attempts to smuggle two Brazilian cardinals at New Orleans, La., in April were frustrated, and the birds were seized and donated to the Audubon Park Zoo. Before the legal division of the Customs Service, the smugglers were fined $10 each, and the steamship company $20 for failure to declare the birds. Another fine of $90 was imposed in a similar case of attempted smuggling at New York.

Fines also were collected from members of the crew of a steamer for entering two monkeys and two canaries at Morehead City, N. C., without permits. Upon advice from the customs officials, the purchasers returned the birds and mammals to the ship, which left for Scotland.

MIGRATORY BIRDS EXCLUDED

Numerous applications were rejected for permits to import, usually from Mexico and Cuba, migratory birds the possession of which is forbidden by the Federal law, except for scientific purposes. The Bureau's inspectors at several ports of entry also refused permits to passengers to enter indigo buntings, painted buntings, and blue grosbeaks, but permitted them to donate the birds to public zoological parks for scientific and educational purposes. Satisfactory progress also is being made in the exclusion of native migratory birds from the channels of the cage-bird traffic.

SPECIES ENTERED UNDER PERMIT

BIRDS

There were 1,925 permits issued, including 37 at Honolulu, Hawaii, for the importation of foreign birds and mammals, and 426 importations were inspected. A total of 270,000 foreign birds were imported into continental United States, as compared with 300,817 last year, including 136,704 canaries, 3,086 parrots, 79,465 Mexican quail, 14,905 Hungarian partridges, 1,937 pheasants, and 33,903 miscellaneous birds, decreases being especially notable in the numbers of quail and canaries. At Honolulu 1,090 foreign birds were entered.

Entries of Hungarian partridges from Europe greatly exceeded those of several years past. Several large shipments containing 1,500 to 2,000 birds each were brought in during January and February, principally for stocking purposes in Pennsylvania. About 400 of these partridges were imported from Canada, and 9 bamboo partridges (*Bambusicola fytchii*) came from China.

Bobwhite quail imported from Mexico aggregated 79,465, a decrease of more than 21,000 from the number imported last year. The quail imported during the past season were distributed to the following States: Mississippi, 23,374; Indiana, 23,350; Texas, 15,548; Kentucky, 4,040; West Virginia, 3,214; Tennessee, 1,350;

South Carolina, 1,275; North Carolina, 1,033; Florida, 925; Delaware, 795; New York, 525; Pennsylvania, 200; District of Columbia, 175; Illinois, 155; Alabama, 125; Missouri, 115; Maryland, 100; and the rest in small lots of fewer than 100 each to several other States.

Among the more interesting pheasants imported were 2 Lady Amherst pheasants (*Chrysolophus amherstiae*), from China; 13 copper pheasants (*Syrmaticus soemmerringi*), from Japan; 1 Bulwer's pheasant (*Lobiophasis bulweri*) and 12 crested fire-backed pheasants (*Lophura rufa*), from Singapore; and 1 Temminck's tragopan (*Tragopan temminckii*), which arrived in a shipment from France.

Quarantine restrictions continue to be maintained by the Public Health Service on the importation of birds of the parrot family, and in addition the State and city health authorities in New York prohibited by regulation last April the importation, breeding, and sale of birds of the psittacine family, with an exception allowing public zoological gardens or laboratories, in which scientific research is being carried out, to receive or import such birds under certain restrictions. Several other States and cities have taken similar action against the importation of psittacine birds, including Connecticut, California, Maine, Minnesota, Oregon, Territory of Hawaii, and Pittsburgh, Pa. Parrots in great variety were imported, however, during the year, including 4 Alexandra parrots (*Spathopterus alexandrae*), 6 Barraband parrots (*Polytelis swainsonii*), 1 purple-crowned lorikeet (*Glossopsitta porphyrochephala*), 8 Stanley's parakeets (*Platycercus icterotis*), and 2 crimson-winged parakeets (*Aprosmictus erythropterus*) from Australia; 1 vulturine parrot (*Psittrichas fulgidus*), 3 Banksian cockatoos (*Calyptorhynchus magnificus*), and 7 Kramer's parakeets (*Psittacula krameri*) from Sumatra; 2 Peruvian parakeets (*Forpus coelestis coelestis*), and 41 orange-winged parakeets (*Brotogeris pyrrhopterus*) from Ecuador.

Other interesting importations were 1 oropendola (*Zarhynchus wagleri*) and 4 thick-billed pygmy grosbeaks (*Oryzoborus crassirostris*), from Venezuela; 1 Sumatran hilltit (*Mesia laurinae*), 1 Sonnerat jungle fowl (*Gallus sonneratii*), and 1 Count Raggi's bird of paradise (*Paradisea raggiana*), in shipments from France; 2 Mallee fowl (*Leipoa ocellata*), 3 tawny frogmouths (*Podargus strigoides*), and 6 Cape Barren geese (*Cereopsis n. hollandiae*), from Australia; 1 Wilson's bird of paradise (*Schlegelia wilsoni*), 11 red birds of paradise (*P. rubra*), 2 lesser birds of paradise (*P. minor*), one 12-wired bird of paradise (*Seleucides ignotus*), 1 pied cuckoo shrike (*Lalage nigra*), 5 purple-capped fruit doves (*Ptilinopus regina*), 1 silver-eared hilltit (*Mesia argentauris*), 5 East Indian nonpareils (*Erythrura prasina*), 6 Celebian imperial pigeons (*Ducula paulina*), 1 Malayan wreathed hornbill (*Rhytidoceros undulatus*), 3 Molucca megapodes (*Megapodius freycinet*), 2 lesser frigate birds (*Fregata ariel*), and one Malay fish-owl (*Ketupa ketupa*), from Sumatra; 21 Siberian blue robins (*Luscinia cyane*), and 2 Bonin Island blue pigeons (*Columba janthina nitens*), from Japan.

MAMMALS

There has been a noticeable decrease in the importation of black bear cubs from Canada. Only 87 were brought in, as compared with 113 last year.

During the calendar year 1937, there were imported into the United States, chiefly from Canada, 1,256 live silver foxes, as compared with only 414 in 1936. A considerable number of the 1937 importations were probably brought in for pelting, however, since the duty on live animals is only 15 percent, whereas on pelts it is 50 percent ad valorem. Other fur animals imported during the same year were 443 live minks, compared with 591 during 1936; and 8 nutrias, 4 martens, and 2 fishers.

Importations of monkeys included three gorillas and several chimpanzees, baboons, and mangabeys, from Africa: orangutans and gibbons from Singapore; and a great variety of the smaller monkeys, including marmosets, ringtails, spider monkeys, and capuchins from Central America and South America. Rhesus monkeys from India continued to lead all other species in point of numbers, 15,851 having been imported.

Among the more interesting mammals imported were 1 Sumatran orangutan (*Pongo abelii*), 1 Bornean orangutan (*P. pygmaeus*), 5 slow loris (*Nycticebus coucang*), 1 clouded leopard (*Neofelis nebulosa*), 2 golden cats (*Profelis temminckii*), 1 small-clawed otter (*Micraonyx leptonyx*), 2 tree kangaroos (*Dendrolagus inustus*), 1 Asiatic marten (*Charronia flavigula henricii*), 10 Egyptian jerboas (*Jaculus jaculus*), from Sumatra: 1 pampas cat (*Felis passerum*) shipped from Holland; and 2 two-toed sloths (*Choloepus didactylus*), and 1 prehensile-

tailed porcupine (*Coendou prehensilis*), from Venezuela; and 2 giant pandas (*Aeluropoda melanoleuca*) from Shanghai, China.

PERMITS UNDER THE MIGRATORY BIRD TREATY ACT

PERMITS FOR SCIENTIFIC PURPOSES

Two hundred and twenty-three permits for scientific purposes, general or under specific limitation, were issued authorizing the taking of migratory birds, and 1,942 were outstanding at the close of the year. Permits of similar limitation to possess migratory birds lawfully acquired for scientific purposes were issued to 180 persons, and the total number outstanding at the close of the year was 434. For possession of one or a few specimens found dead, 208 permits were issued. For banding migratory birds, permits were issued to 146 persons cooperating with the Bureau.

One formal order of the Secretary was issued to revoke the permit of a holder who had sold, and in consummation of the sale, had transported, migratory birds in violation of the regulations and the terms of the permit. This action was promptly followed by like revocation by the State game department concerned.

PERMITS FOR WATERFOWL PROPAGATION

Permits to take migratory waterfowl for propagation were issued to 31 persons, each permit limiting the species or the number of individuals and the time during which they might be taken. To possess migratory waterfowl lawfully acquired permits were issued to 229 persons.

It became necessary to recall, cancel, or revoke 415 propagating permits because of failure of permittees to render the annual reports required by the regulations or to surrender the permits when they discontinued propagating operations. At the close of the year 3,800 propagating permits were outstanding.

Reports submitted by permittees disclose that 3,683 wild geese and 61,951 wild ducks were raised in captivity, of which 56,477 were mallards, 3,608 black ducks, 525 wood ducks, and the remainder principally teals, ringnecks, wigeons, pintails, and redheads. Sales of propagated migratory waterfowl for food included 12,825 ducks and 438 geese; and for propagation, 10,096 ducks and 1,429 geese. From the propagating stock, 12 swans, 37 mourning doves, and 14 band-tailed pigeons were produced. Of propagated birds, 13,492 ducks and 285 geese were liberated.

DEPREDATION PERMITS

Since the Migratory Bird Treaty Act of 1918 became effective many general and special orders and some special permits have been issued authorizing the killing of one or more species of migratory birds found injuring agricultural and horticultural crops and other property. In order to condense these orders and to bring about uniformity in the issuance of permits, the Secretary, on June 10, revoked all previous permits and all but two previous orders—one applying to certain blackbirds and sparrows in California and the other to blackbirds throughout the United States. Provision is made in this order for the issuance of permits by the regional directors of the Survey, when authorized by the Chief of the Bureau, reserving to the Chief the issuance of permits involving the killing of migratory waterfowl except mergansers. Investiture of this authority in the regional direcors will facilitate the issuance of the permits usually required in sudden and unexpected emergencies.

COOPERATIVE CONTROL OF INJURIOUS ANIMALS

Expenditures in cooperative predator and rodent control involved $609,022 from regular departmental appropriations, supplemented by $456,324 from cooperating States, $818,598 from cooperating counties, livestock associations, and others, and about $512,877 from emergency funds on work under Biological Survey supervision. The year's catch of predators taken through this cooperation aggregated 94,040, exceeding last year's records by 4,751, and consisted of 84,844 coyotes, 1,360 wolves, 7,189 bobcats and lynxes, 392 bears, and 255 mountain lions. Cooperative campaigns for rodent control involved the treatment of 29,204,282 acres infested with prairie dogs, ground squirrels, pocket gophers, jack rabbits, porcupines, field mice, cotton rats, kangaroo rats, and woodchucks, and of 237,788 premises for the eradication of common brown rats.

Publications issued on control procedure and matters related to control operations included Leaflet No. 132, Den Hunting as a Means of Coyote Control, and the following mimeographed leaflets: European and American Methods of Rat Control (BS–113), Cultural and Other Methods for the Control of Injurious Wildlife (BS–115), and Protecting Orchard Trees from Deer (BS–117). In addition, there was released one reel of sound motion picture entitled "Mouse Control in Orchards."

PREDATORY-ANIMAL CONTROL

Predatory animals, especially coyotes, continue to be an important cause of losses in livestock herds and flocks, as well as among big-game animals and upland game. An estimate by the Forest Service of domestic livestock and big-game animals killed by predatory animals on national forests only during the fiscal year 1937 includes 122,077 big-game animals, 1,038 cattle, 41 horses, 156 goats, and 78,346 sheep. The heavy loss of sheep is significant when one considers that the flocks are attacked on national forests during the summer grazing season only, which averages little more than 3 months. The increased interest in the matter among livestock producers, sportsmen's associations, State legislatures, and boards of county officials resulted in increasing the funds available for predator control in cooperation with the Biological Survey.

An expedition into Mexico, in cooperation with the Chicago Academy of Sciences and the Smithsonian Institution, for the purpose of conducting work on the self-photography of mountain lions and bobcats developed further proof of the utility of catnip oil as an attractant to these animals.

Acting upon a resolution of the National Woolgrowers Association adopted at its annual convention at Salt Lake City, Utah, the Wyoming Woolgrowers Association organized an advisory committee to aid in coordinating predator-control activities. Its first meeting, held in April at Cheyenne, was attended by representatives of all organizations interested in the predator problem within the State. In a letter received from the president of the South Dakota Woolgrowers Association the serious aspect of the predator situation in that State is described and it is emphasized that livestock losses attributable to predatory animals have been a major factor in forcing many livestock owners out of business.

A number of valuable predatory-animal specimens were collected by the field force for addition to the Survey's mammal collection in the National Museum. Among these is a coyote taken in Wyoming in November which weighed 74¾ pounds and measured 63 inches in length.

SOME BENEFITS FROM THE WORK

Previous to 1937 the largest single sheep-raising outfit in Nevada reported annual losses of 8 to 10 percent in its herds through coyote depredations. During 1 month in the fall of 1937, 130 coyotes were trapped on the company's range, with the result that losses were curtailed to a negligible figure. Other ranching outfits have reported a 75-percent reduction in lambing-range losses this year as a result of coyote-control measures.

During December and January a pack of eight wolves migrated across the Mexican border into Arizona and New Mexico. Bureau hunters of these two States assigned to capture them took the last member in Arizona on March 17. The skin and skull of one of the pack, a male measuring 6 feet in length, were added to the Bureau's collection.

In May a large renegade wolf, known to have been a killer of long standing in Le Flore County, Okla., was captured after having been hunted relentlessly in that State for 2 years. A bear that had killed 24 young purebred rams valued at $25 each on one ranch and had a reputation as a stock killer for a number of years, was taken near Cody, Wyo.

Previous to 1914 it was nearly impossible to raise turkeys in McCullough County, Tex., because of severe wolf depredations, and the annual income from this industry in that county was less than $5,000. During the past several years, however, the wolves have been put under control, and the turkey industry has risen in importance, now amounting to $300,000 annually.

Improvements in trapping technique are shown by a 2½-year record in Wyoming on trap-crippled coyotes, which reveals that Bureau hunters took 1,059 peg-legged coyotes and made only 410 cripples, whereas during the current year these hunters took 416 peg-legged coyotes and crippled only 138. This has further significance in that trap-crippled coyotes are more destructive to livestock because of their lessened ability to capture wild prey.

Requests for assistance in coyote control were received from Mississippi, where a recent State law authorizes the game and fish commission to cooperate with the Bureau in control work. A Survey hunter was detailed to Mississippi in March, and through his immediate taking of three coyotes succeeded in curtailing livestock and poultry losses in Pearl River County.

In cooperation with the Forest Service in Georgia, North Carolina, South Carolina, Florida, and Tennessee, the Survey detailed an experienced trapper to train forest officers and game protectors in the technique of trapping wildcats and foxes on forest game-management areas. One result was a threefold increase in the wild-turkey crop over that of the preceding year on one area in Georgia.

EMERGENCY PROGRAMS

Predator control through the agency of Works Progress Administration was continued in Utah, Idaho, Wyoming, Montana, and Oregon, and provided an important supplement to the Bureau's regular program in those States. These projects have afforded opportunity to establish control and protect livestock and game from predatory-animal depredations, where it would otherwise have been impossible.

RODENT CONTROL

In addition to the severe damage inflicted by rodents on agricultural and horticultural crops and range plants, and the recognition that these animals constitute reservoirs and carriers of certain diseases communicable to man, other phases of rodent damage deserve mention, such as damage to mechanical structures and spoilage of food in storage. Pocket gophers, through their burrowing 7 feet into the earth supporting a concrete spillway on the Kyle Dam on the South Dakota Pine Ridge Indian Reservation, started a leak that resulted in the wash-out of the dam. Repairs will cost in the neighborhood of $25,000. Approximately 63,000 barrels of oil stored in a surface tank at Gladewater, Tex., were released into the Sabine River when floodwaters entered pocket gopher runways in the tank dam. Cooperative rat control on the pier of the Galveston Wharf Co., where 84,000 sacks of flour were stored, was so effective that only 2 sacks were destroyed by rats this year, whereas previously 50 percent of the stored flour was damaged.

A new outlet for the meat of jack rabbits has been developed in Colorado which should serve to further efforts toward their control. A private company in Denver last year purchased 300 tons of the meat from farmers and ranchers, which was processed and placed in cold storage for resale to members of the Rocky Mountain Fur Growers Association for fox feed. The fox growers report that jack rabbit meat is an excellent ration and are enthusiastic over this new source of feed supply. Prospects for an expansion of the industry appear good.

EMERGENCY PROGRAMS

Cooperative rodent control was conducted through the medium of the C. C. C. and the Works Progress, Agricultural Adjustment, Farm Security, and Emergency Relief Administrations. The C. C. C. projects were conducted cooperatively with the Forest Service and the Soil Conservation Service of the Department of Agriculture and with the Division of Grazing, Bureau of Reclamation, and Office of Indian Affairs of the Department of the Interior. The work, which was supervised by trained and experienced field workers of the Survey, was undertaken only where control would lead to the restoration and development of wide areas of grazing lands, and for the protection of irrigation projects, agricultural crops, forest-tree plantings, horticulture, and engineering structures on soil-conserving projects.

Throughout the farm-forestry project areas within the Dakotas, Nebraska, Kansas, Oklahoma, and Texas, it was necessary to protect young tree plantings from being destroyed by rodents, especially by jack rabbits, which are a constant menace to the successful growing of trees.

RODENT CARRIERS OF PLAGUE AND TYPHUS

Measures for the control of rodent-plague carriers were continued at points of previous infection and steps taken for the inauguration of control work at recently discovered points. The Public Health Service of the Treasury Depart-

ment reported that plague infection was identified on June 27, 1938, in 1 ground squirrel (*Citellus armatus*) and in 19 fleas taken from 9 squirrels of a related species (*C. elegans*) collected 15 miles northwest of Evanston, Uinta County, Wyo. This is stated to be the first positive demonstration of plague among wild rodents in Wyoming. The Public Health Service reports that sylvatic plague was found among native rodents in additional localities as follows: Douglas and Clark Counties, Nev.; Gallatin County, Mont.; Wasatch, Kane, Cache, and Morgan Counties, Utah; Lincoln County, Wash.; Union, Baker, and Malheur Counties, Oreg.; and Bear Lake County, Idaho. Several new foci of infection also were found in counties from which plague was reported last year.

Typhus fever of an endemic type increased rapidly in Georgia and called for increased rat control in cooperation with the State Health Department. Typhus fever cases reported by the Health Department of Texas showed a marked increase, especially in the city of Austin. Cooperative rat-control campaigns directed by the Biological Survey were immediately inaugurated to stamp out the infection.

RANGE IMPROVEMENT BY RODENT ERADICATION

Supplementary to rodent control for range improvement conducted by C. C. C. camps, operating under the jurisdiction of the Forest Service and the Division of Grazing, the Survey extended supervision over control work on grazing areas in connection with other range-improvement projects of these agencies.

ORCHARD MOUSE CONTROL IN THE NORTHEAST

Progress has been made in the introduction of more effective methods of orchard mouse control in the Northeastern States. Orchardists, nurserymen, and farmers are becoming more conscious of the serious damage to their crops inflicted by tree-girdling field mice, and enthusiasm over control operations has increased. For the first time it has been possible to employ cooperative field workers to demonstrate and supervise mouse-control projects.

Orchardists owning three-quarters of the apple trees in Connecticut are faced with mouse-damage problems, and in many large orchards 75 percent of the trees are damaged to such an extent that they no longer bear a paying crop. Severe damage is inflicted also on commercial garden crops and ornamental shrubbery.

In the Champlain Valley fruit section of New York one orchard had 800 20-year-old apple trees completely girdled by mice, and in other sections mouse damage to orchard trees ran from 55 to 70 percent. On Long Island severe damage was inflicted on white pine trees by pine mice.

Cooperative funds aggregating $5,424.98 have been provided in Maine, New Hampshire, Vermont, Massachusetts, and Connecticut to finance mouse-control operations in cooperation with the Bureau.

CONTROL IN SOIL-CONSERVATION DISTRICTS

Several States have enacted legislation providing for the establishment of soil-conservation districts in cooperation with the Department of Agriculture. In many of these districts, wherein a sound policy of land use is being established, rodent control is of paramount importance, it having been determined by the local agencies involved that proper land use cannot be realized without the removal of heavy rodent populations. With that in mind, the board of supervisors of the Great Divide Soil Erosion District in Moffat County, Colo., requested assistance from the Bureau in prosecuting ground squirrel control within that district.

SUPPLY DEPOT AND LABORATORY

Construction of an addition to the present supply depot at Pocatello, Idaho, was inaugurated in cooperation with the Works Progress Administration and the Pocatello Chamber of Commerce. When completed the building will provide approximately 23,000 square feet additional room, thus affording more adequate storage space for rodent-bait materials, field supplies, and miscellaneous equipment. A machine shop, chemical vault, small-mammal room, and production laboratory also will be provided.

In cooperation with the Pocatello Chamber of Commerce, the supply depot prepared and distributed to cooperators in the United States 1,646,307 pounds of rodent-bait materials, and 529 gallons of paste bait for jack rabbit control. The supply depot has also dispensed to cooperating agencies a carload of predatory-animal traps and trap parts, and has manufactured horse and utility trailers, pocket gopher probes, trap stakes, and other equipment used in mammal control.

CONTROL METHODS RESEARCH

Investigations conducted by the Control Methods Research Laboratory at Denver, Colo., have progressed on several lines, including improvement of lethal baits for controlling range and farm-land rodents, orchard mice, and rats, and of rodent repellents for use in connection with silvicultural plantings. Ecological studies also have been made of various species of field rodents, looking toward new approaches to problems in control. The laboratory has also processed and prepared baits for use in predator control.

REPELLENTS AND FUMIGANTS

Experiments with repellent sprays for preventing jack rabbit depredations were continued in national-forest areas in the Northwestern States, where they involved 11,000 yellow and Jeffrey pine seedlings. In the Kitsatchie National Forest, La., similar protection against cottontail rabbit damage was tested with 7,000,000 slash pine seedlings. Further work on repellent sprays also was conducted in Colorado on farm wood lots.

The laboratory experimented with poison-gas pyrotechnic cartridges and other means of application of various toxic gases in fumigating burrows for rodent control. Definite progress has been made, and under certain conditions this method has produced encouraging results.

RODENT AND PREDATOR STUDIES

Looking toward more effective operational work in predator control, the laboratory inaugurated predatory life-habit studies in Wyoming to determine lines of predator migration, relationship of denning areas and predator populations to soil type and land topography, and relationship of predator distribution to beneficial wildlife, livestock, and rodent populations.

On the Kisatchie National Forest milo bait was used in experiments for the control of pocket gophers, which inflict heavy damage to seedling trees on plantation areas. Ecological studies on forage plant-pocket gopher relationships indicate that the rodents are more prevalent on overgrazed areas, where the less desirable, bulbous-type plants have become established. These heavy infestations serve to aggravate an already bad situation and retard the establishment of desirable forage plants. These studies indicate the need for better grazing control that will keep the range in a climax sod: this in turn would aid in controlling the numbers of pocket gophers.

Investigations continued in the Northeastern States, including life-habit studies of orchard mice, surveys of damage to horticultural and nursery crops, and improvement of bait formulas. Progress has been made in perfecting a more acceptable and efficient bait for use in orchard mouse-control work. Studies also were made looking to improvement of field applications of mouse-control methods in order to assure protection to beneficial forms of animal life.

HAWAIIAN RODENT-CONTROL PROJECT

The work of rat abatement for the protection of pineapple, sugarcane, coffee, and macadamia nuts, and for the control and prevention of typhus fever, bubonic plague, and trichinosis, continued in Hawaii with good progress, in cooperation with the Agricultural Experiment Station and Extension Service of the University of Hawaii and the Territorial Board of Health. Research resulted in the improvement of sausage and grain-type baits—red squill baits that can be used safely in cities and rural communities—in the method of vacuum-packing baits for ready use, and in trapping technique. Education work was conducted along the lines of proper rat control, ratproofing of buildings, and other preventive methods. In addition to the research and educational program, the Rat Abatement Laboratory also served the Territory in manufacturing rat bait for distribution to cooperating agencies.

WILDLIFE CONSERVATION IN ALASKA

ALASKA GAME LAW AMENDMENTS

An act amending the Alaska Game Law passed by Congress and signed by the President on June 25 (Public Law No. 728, 75th Cong.) authorizes the Alaska Game Commission to purchase, maintain, and operate aircraft, a facility that has become essential with the marked economic developments in the Territory. With fur dealers and trappers rapidly abandoning boat, dog-team, and snowshoe travel in favor of aircraft, it is necessary for wildlife agents to utilize the same expeditious transportation. The amended act also confers upon the Commission authority, which heretofore had been limited, to carry on wildlife investigations, feed wildlife when necessary, and restock depleted areas, in addition to enforcing the Alaska Game Law. It also gives the Secretary of Agriculture discretionary authority, whenever conditions appear to warrant, to conserve the wildlife resources of the Territory or to prevent nonresident trappers from crowding out native Indians and Eskimos, and to require 3 instead of 1 year's residence in the Territory before nonresident trappers can become eligible for resident trapping licenses.

CHANGES IN REGULATIONS

The 1938–39 regulations of the Secretary of Agriculture, published in Alaska Game Commission Circular No. 15, provide for a close season on martens throughout the Territory and prohibit the taking of all fur animals except black bears and wolverines in fur district 1, which embraces all of southeastern Alaska. The open season on bighorn, or mountain, sheep and on mountain goats was reduced 1 month, to close on November 30 instead of December 31. The limit on caribou was increased from two to five north of the Yukon River and reduced from five to three south of it. An open season on beavers is provided during the spring of 1939 for fur districts 4, 5, 6, and 7, with a seasonal limit of 10. The Kenai Peninsula west of the Alaska Railroad remains closed for the taking of minks, martens, land otters, weasels, foxes, and lynxes. The Commission approved the revised form of the regulations as prepared by a committee appointed to revise, simplify, and clarify them.

LAW ENFORCEMENT

Two cases of outstanding importance were reported and successfully prosecuted in the enforcement of the Alaska Game Law:

An Alaskan fur trader operating an extensive "fence" for trappers smuggling furs of wolves and coyotes from Canada into Alaska was apprehended and convicted. To reduce depredations on big game, the Territory pays a bounty of $20 each on these animals, but Canada pays none. The trader fence collected $800 bounty on the smuggled animals, which he was required to refund to the Territory, and in addition paid fines and costs amounting to $400.

Two Alaska wildlife agents operating the Commission's chartered plane in the Stony River country apprehended two white men involved in the most vicious violations that have come to the attention of the Commission. They were operating trap lines more than 100 miles long nearly 2 months after the close of the season and had killed no fewer than 10 moose, including at least 1 cow with an unborn calf, the meat of which was cached along the trail for dog feed and allowed to spoil. When they were apprehended their packs contained poison, and they had driven the Stony River Indians, whose trapping territory they had usurped, out of the country by armed force. The violators were sentenced to serve 1 year each in jail, and the trial judge placed the 13-year-old son of one, who was being trained in the law-breaking habits of his father, in the custody of the agents so that he might attend school.

The problem of adequate law enforcement in Alaska has materially increased during the past 2 years, in a large measure because of the influx of nonresident trappers. In all, 346 violations were reported by the Commission, as compared with 329 in 1937 and 120 in 1936. The largest number reported in any 1 year prior to that time was 188, in 1932. Intensive enforcement is partially responsible for the apprehension of violators, but it is apparent that many newcomers to Alaska are under the impression that they can live off the country with little regard for wildlife-protective laws. The Commission reports an alarming tendency on the part of this type of violator to usurp the rights of the less aggressive and more peaceable native Indians, Eskimos, and Aleuts.

The 346 cases of violations reported included 71 involved with illegal acts by aliens, and fines in the amount of $13,468 were assessed in addition to jail sentences aggregating 3,845 days. The furs seized totaled 867, of which 581 were of beavers. A total of 57 game animals and 21 game birds illegally taken were seized and 169 firearms confiscated. The estimated value of seized articles was $10,962.

WILDLIFE-RESTOCKING PROJECTS

Four elk were liberated on an area near Ketchikan, Alaska. These animals were transported from Washington State on the Commission's vessel *Brown Bear*, the crating and incidental expenses being paid by Ketchikan sportsmen.

The results of some of the restocking projects of former years are gratifying. The elk on Afognak Island and the buffalo in the big delta country, near Fairbanks, are well established and annually show a substantial increase. At the Nunivak Island Wildlife Refuge the introduced herd of musk oxen has increased to 50 animals, including 11 calves of the year.

PREDATOR CONTROL IN THE TERRITORY

Under Bureau supervision and in cooperation with the Reindeer Service and the Office of Indian Affairs of the Department of the Interior, the Alaska Game Commission, and the Forest Service, wolf and coyote control was continued with satisfactory results, mainly for the protection of reindeer herds. It was reported, however, that mountain sheep also suffer heavily from wolf depredations in the Rainy Pass section.

A building was constructed in cooperation with the Forest Service C. C. C. camp at Juneau for use in preparing scented-bait material, which is distributed to trappers throughout the Territory, and 2,470 ounces were distributed and 463 wolf traps were supplied to trappers, in addition to 700 furnished by the Indian Service. The C. C. C. enrollees assisted both in conducting trapping operations and in training natives in proper trapping technique.

RESEARCH ON ALASKA WILDLIFE

Wildlife research was resumed with the assignment of a resident biologist to the Territory. The program was restricted to (1) studies on management of the Kenai moose herd and its relationship to agricultural developments, (2) study of the problem of brown bears versus cattle on Kodiak Island, (3) management studies of musk oxen and carideer (caribou-reindeer cross) on Nunivak Island, and (4) studies of the food habits and diseases of big game.

A second expedition, using the motorship *Brown Bear*, spent the summer on the Aleutian Chain. In the two seasons nearly all the islands have been visited by Bureau scientists, who made a brief survey of the bird and mammal life of each. Special attention was given to the fox-farming and bird-colony relationships, and observations were made on vegetation, water supply, and the invertebrate fauna. Several hundred specimens were collected and 10,000 feet of motion pictures taken.

Information gained from the research program and from field surveys of wildlife and its habitat will be of material aid in law enforcement and the application of sound wildlife policies.

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REPORT OF THE CHIEF OF THE BUREAU OF CHEMISTRY AND SOILS, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF CHEMISTRY AND SOILS,
Washington, D. C., October 24, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I present herewith the report of the Bureau of Chemistry and Soils for the fiscal year ended June 30, 1938.

Sincerely yours,

HENRY G. KNIGHT, *Chief.*

CONTENTS

	Page
Introduction	2
Carbohydrate investigations	3
Sugarcane and cane sugar	3
Beet sugar	3
Farm-made sirups	4
Honey	4
Starches	5
Cellulose	6
Miscellaneous carbohydrates	6
Oil, fat, and wax investigations	6
Vegetable oils	6
Wax from leaves of domestic palm	7
Research methods	7
Food research	7
Citrus fruit products	7
Apple products	8
Miscellaneous fruit products	9
Frozen-pack investigations	10
Vegetable products	13
Staling of bakery products	13
Rancidity	14
Mineral elements in food products	14
California walnuts	15
Phytochemical investigations	15
Plant viruses	16
Preserving biological specimens	16
Pharmacological investigations	16
Enzyme investigations	17
Retarding deterioration of eggs	17
Enzyme action at low temperature	18
Industrial farm products research	18
Hides and skins	18
Tanning materials	19
Leather	19
Utilization of farm wastes	19
Lignin	20
Hemicelluloses and lignocelluloses	21
Fermentation investigations	21
Motor fuels	22
Chemical conversion of oils, fats, and waxes	23
Plastics	23
Soybean products	24
Chemical weed killers	25
Biological stains	26
Naval stores research	26
Chemistry and technology of naval stores (turpentine and rosin)	26
Production and processing of naval stores	27
Cooperation with States in naval stores work	28
Naval stores research—Continued	Page
Naval stores statistics	29
Protein and nutrition research	29
Digestibility of proteins	29
Decystinized casein	29
Amino acids in beans	30
Effects of storage on proteins of grains and seeds	30
Vitamins	31
Allergen investigations	31
Chemical engineering research	32
Agricultural fires	32
Dust explosions	33
Agricultural accident prevention	35
Service work	35
Fertilizer research	35
Catalyst and high-pressure investigations	35
Fundamental physical and chemical investigations	36
Nitrogenous fertilizer materials	36
Biochemical and organic nitrogen investigations	37
Phosphates	38
Potash salts and byproducts	39
Mixed fertilizer investigations	40
Soil chemistry and physics research	41
Limestone soils	41
Alluvial soils	41
Subtropical soils	41
Desert soils	41
Nonfertile soils	42
Selenium in soils	42
Physical properties of soils	42
Mineral composition of soil colloids	43
Structure of peat	43
Quick chemical tests for soils	43
Service work	44
Soil survey	44
Objectives	44
State cooperation	44
Regional investigations	45
Productivity rating	45
Preparation of soil maps	45
Progress	46
Special work of the soil survey	48
Yearbook for 1938	49
Information and publications	49
List of publications	49
United States patents	55

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INTRODUCTION

The Bureau of Chemistry and Soils is a research organization engaged in the application of chemistry, physics, and other sciences to the improvement of agriculture. This broad field includes classification and mapping of the soils of the United States; studies of soils with regard to their agricultural value, their characteristics in relation to productiveness, their origin and development, and their chemical and mechanical compositions; studies of the fertilizer resources of the United States and methods of manufacturing fertilizer materials, including nitrogen and its fixation, phosphates, potash, concentrated fertilizers, organic waste products, and miscellaneous soil amendments; studies on the composition, properties, preservation, and utilization of agricultural products and byproducts; studies of the physiological effects of food products and possible food contaminants on the human organism: development of improved processes for the production of rosin and turpentine; and development of means for preventing farm fires and dust explosions.

The organization consists of the offices of Chief, Assistant Chiefs, Adviser in Chemical Research, Business Administration Division, Information Division, and the following research divisions: Carbohydrate Research, Chemical Engineering Research, Fertilizer Research, Food Research, Industrial Farm Products Research, Naval Stores Research, Protein and Nutrition Research, Soil Chemistry and Physics Research, Soil Survey, and Chemical Investigations of Allergens in Agricultural Products.

The administrative, professional, and technical staff of the Bureau during the year averaged 347 persons, including 168 chemists, 12 physicists, 18 engineers, 6 technologists, 21 soil scientists, 36 soil surveyors, 4 cartographers, 21 draftsmen, 10 bacteriologists, 2 mycologists, 1 microscopist, 2 physiologists, 1 pathologist, 4 pharmacologists, 1 clinical specialist, 1 medical technician, 1 specialist in plant preservation, 8 skilled mechanics, 13 scientific aides, 13 cooperative agents, 3 business administrators, and 1 editor. About 128 professional and technical employees of the Bureau were located in various parts of the country in 21 field laboratories, where work was done on the utilization of fruits and vegetables, principally for food purposes, industrial utilization of soybeans and sweetpotatoes, industrial utilization of agricultural byproducts, production and utilization of turpentine and rosin, cane sugar and sirup investigations, damage to agricultural land from smelter fumes, and supervision of soil surveys. Forty-five scientists whose headquarters are in Washington, D. C., were in the field almost continuously on soil survey work. At the close of the year the total number of employees, both technical and clerical, was 583, of whom 180 were field employees.

Practically all the soil survey work as well as much of the research work was done in cooperation with State agricultural experiment stations, educational institutions, or other State or local agencies.

During the year the Bureau participated in the Department of Agriculture's general program of basic research in agriculture under the Bankhead-Jones Act of June 29, 1935, by carrying on research on enzyme action at low temperatures; plant mineral constituents derived from soils and their relation to nutrition and health; allergens of agricultural products; preserving plant specimens in natural condition; hemicelluloses and lignocelluloses of straws and forage crops; and industrial utilization of the soybean and soybean products. In addition, the Bureau collaborated with the Bureau of Plant Industry on a Bankhead-Jones project by making pathological and chemical studies on plant viruses, and in investigating the chemical eradication of weeds, and with the State Department by studying the extent of damage to agricultural land in northeastern Washington by smelter fumes originating in Canada.

The regular appropriation for the work of the Bureau during 1938 was $1,425,431. Additional funds were received by allotments from other appropriations, including $179,151 from the fund for special research under the Bankhead-Jones Act of June 29, 1935, $22,683 from the State Department for smelter-fumes work, $1,800 from the Farm Credit Administration for soil survey work, $17,691 from the Agricultural Adjustment Administration for the preliminary survey for determining the locations and programs of regional laboratories provided for in the Agricultural Adjustment Act of 1938.

Much of the time of administrative officers and certain division chiefs was given to a consideration of the possibilities for increased industrial utilization of agricultural products and the preparation of estimates of the funds that would be required to attack the problems of increased industrial utilization on

a comprehensive scale. These estimates formed the basis of legislation enacted by the Congress providing for extensive expansion in the research activities of the Department of Agriculture on the industrial utilization of agricultural products.

The more important results of the work of the Bureau during the year are reported in the following pages. Further information concerning many of the subjects discussed may be obtained from the 267 publications issued by the Bureau during the year and listed at the end of this report together with a list of the 14 patents issued to Bureau scientists.

CARBOHYDRATE INVESTIGATIONS

SUGARCANE AND CANE SUGAR

Studies on the composition and clarifying properties of sugarcane juices as affected by variety, fertilization, and soil conditions were continued in cooperation with the Bureau of Plant Industry. In tests by a standardized clarification procedure the varieties C. P. 28–11 and C. P. 28–19 gave large volumes of defecation mud as compared with that given by other varieties from the same fields. The variety C. P. 29–320 gave a relatively low volume of defecation mud and juice of excellent clarity. All the other newer varieties tested gave defecation mud volumes in excess of those found for older varieties, such as P. O. J. 36–M and C. P. 807. The use of nitrogen fertilizers alone tended to increase the defecation muds and to decrease the clarity of the juices, while a balanced fertilizer treatment had much less effect.

As the result of a freeze and subsequent unfavorable weather in Louisiana toward the close of the 1937–38 cane harvesting season, the cane still standing deteriorated to a marked degree, yielding juices that were very difficult to clarify and work in the factory. The Bureau found that the direct cause of this deterioration was partial fermentation of the sucrose to acetic acid, d-mannitol, dextran, and other products. Dextran, a gummy substance, was mainly responsible for the factory trouble because it increased the viscosity of the juices enormously and thus retarded filtration and rate of crystallization. Assistance was given to plantation sugar houses in developing methods for evaluating and handling damaged cane to the best possible advantage with existing equipment, and efforts are being continued along this line, particularly to discover a means of eliminating dextran from the juice of damaged sugarcane.

The method recently developed by the Bureau for air graining and curing of third sugars was tried in a plantation sugar factory and found to be practical. Higher yields and better quality of sugars were obtained in 7 weeks than in 6 months by the usual practice.

Work on the principle of clarification by thermo-scum filtration resulted in the design of a continuous juice clarifier for which a public-service patent has been requested.

In cooperation with the Bureau of Plant Industry, an investigation was made of the mineral composition of crusher juices, whole cane, and green tops. The values for the whole mill cane plus the green tops, in conjunction with the yields per acre, were taken to indicate the degree of soil depletion. Comparison of the characteristic mineral contents of varieties of sugarcane and of the effect of different fertilizer treatments on such composition, considered with reference to field costs and yields, should give practical information on selection of varieties and fertilizer needs. The correlation of the composition of the crusher juice with that of the mill cane plus green tops gives factors from which, in the future, soil depletion may be approximately estimated on the basis of crusher-juice analyses.

BEET SUGAR

In a chemical investigation in cooperation with the sugar-beet industry, composite samples of beet sugar representative of all the beet-sugar-producing areas in the United States were again collected in 1937 and subjected to detailed analysis. In general, the results showed still further uniformity of quality. Only 2 of the samples had an ash content above 0.02 percent; 67 samples contained less. In 1929 the average ash content was 0.043 percent; in 1937 it was only 0.011 percent. A tentative formula for the rating of granulated sugars was developed which takes into consideration the ash content as well as reflectance and color and turbidity of the solution as determined photoelectrically by the Brice-Keane instrument.

FARM-MADE SIRUPS

Public demand for extremely mild flavors in table sirups seems to have developed rapidly in recent years. As a rule, the characteristic sugarcane and sorgo flavors are well liked, especially in those sections of the country where people have become accustomed to these sirups. But increasing competition brought about by the sale of mild-flavored, blended sirups has reduced the demand for pure, unblended farm sirups except those of the finest quality. Since pure sugarcane, sorgo, and maple sirups are cash crops of well-recognized value, it is now more necessary than ever before that farmers meet the requirements of the market. Increasing attention must be given to flavor, color, freedom from sugaring and fermentation, absence of unsightly deposits of sediment (dregginess), and to attractive packages and labels. To the extent that farm-scale producers of sirups succeed in offering the trade a strictly quality product they may demand a retail rather than a wholesale price, or from two to four times as much.

Preliminary studies on the sediment in sorgo sirups were conducted in cooperation with the Mississippi Agricultural Experiment Station. Sediment results from spontaneous flocculation of nonsugar substances during concentration of juice to sirup and is influenced by soil and fertilizer, maturity of crop when harvested, and the method and equipment employed in making the sirup. Investigations were made of several varieties of sorgo grown under comparable conditions. In preparing a series of sirup samples from each variety the method was varied to ascertain the best procedure for securing sirups with a minimum amount of sediment. The characteristic behavior of each variety was likewise noted. The most promising procedure so far developed for farm-scale practice consists in sedimentation of the fresh juice in the cold, rapid evaporation with careful skimming to a somewhat higher semisirup density than usual, treatment of the semisirup with malt diastase, and adequate sedimentation of both the semisirup and the finished product.

Farmers' Bulletin 1791 on farm production of sorgo sirup was published. The results of work on the composition of the sorgo plant, with particular reference to the sugars, starch, and nonsugars contained in various portions of the stalk of different varieties at different stages of maturity, were prepared for publication.

In continuation of the investigation on the distribution of sugars in the sorgo stalk under different varietal and environmental conditions, attention was given to the possible commercial recovery of the sugars sucrose and dextrose separately. Applications were filed for two patents covering processes which under certain conditions may be suitable for industrial use.

Cooperation was continued with a number of agencies active in putting the results of the sirup investigations of the Bureau into farm-scale and commercial practice. Assistance was given in the construction and operation of a farmers' cooperative steam cane-sirup plant at Laurel, Miss., and of several smaller community plants in other sections of the South. These plants use improved methods developed by this Bureau in previous investigations. Noteworthy progress has been made in Alabama, where special assistance was rendered to the recently appointed full-time State extension service specialist in sirups.

Preliminary work was done in cooperation with the Bureau of Agricultural Economics to develop combined color and turbidity standards for maple sirup for use in commercial and farm grading.

HONEY

One of the most promising ways for increasing the consumption of honey is its use in the production of commercial baked goods. Honey possesses certain properties that make it particularly valuable for use in baking, especially hygroscopicity, or the ability to absorb and retain moisture. This property of honey makes baked goods in which it is used less likely to dry out and become stale. However, chemical reactions take place between the honey and the ingredients of the mix for certain types of baked goods, producing adverse color effects. Baking experiments in which honey was used to replace sugar showed that honeys of a number of floral types of known composition and color grades gave entirely satisfactory results with whole-wheat breads and various types of cookies. This was also the case with white bread, except that dark grades of honey, like buckwheat, caused objectionable color in the crumb of the loaves.

Cakes made by plain cake formulas in which one-fourth, one-half, three-fourths, or all of the sugar was replaced by honey were entirely satisfactory

except for color. When honey was used to replace one-tenth or less of the sugar, the color developed was negligible. It was found that the color resulted not only from colored substances in the honey but also from chemical reactions between the simple sugars of honey, dextrose and levulose, and certain ingredients of the batter during the baking process. Commercial invert sugar gave results somewhat similar to those obtained with honey, indicating that the nature of the sugars present in honey is responsible for the color development. Honey is entirely satisfactory for use in chocolate cake and similar types where color is not a factor in scoring.

The tendency of a honey to form sugar crystals is objectionable in bottled honey but might be turned to commercial advantage for the production of a smooth fondantlike spread if it were possible to control the size and distribution of the sugar crystals. From a preliminary study of the factors involved in the crystallization of honey, it appears that the concentration of levulose governs to a large degree the extent and nature of the crystallization of dextrose. It is expected that further investigation will lead to means of obtaining desired types of crystallization of dextrose in honey, so that commercially attractive fondantlike honey preparations can be obtained, thus making possible further extension of the market for honey.

STARCHES

An increasing industrial demand for root starches in the United States is indicated by import statistics. In 1937 about 470 million pounds of such starches, mainly cassava, were imported. This was an increase of about 57 percent over the amount imported in 1936. Agriculture would benefit directly from the development of a root-starch industry in this country sufficient to meet this growing demand. With this in mind, the Bureau has continued to give special attention to the sweetpotato as a source of starch because of its wide adaptability as an industrial crop and because its starch has properties that make it eminently suitable for use in sizing textiles, in laundering, and in the preparation of adhesives.

Technical assistance was again given to the farmers' cooperative sweetpotato starch plant at Laurel, Miss., which produced about 500,000 pounds of starch from the 1937 crop, and by operating the factory at full capacity expects to produce about 2,000,000 pounds from the 1938 crop. It was found that the methods used for determining starch in sweetpotatoes and residual pulp sometimes gave erroneous results. From a comparative study it was concluded that the malt diastase method was reliable, provided the samples containing plant tissues were pretreated with calcium or barium hydroxide to prevent certain nonstarchy constituents from being converted into reducing sugars and estimated as starch.

Microbiological investigations in connection with sweetpotato-starch manufacture were begun to discover means for controlling fermentation, particularly during warm weather, and to determine the types of micro-organisms involved and their effect on the quality of the starch.

Investigations were also started on the factors involved in the purification of sweetpotato starch by tabling and to determine the cause of the slow change in starch during storage, particularly as indicated by the viscosity of its pastes, and the proper conditions for improving stability during storage.

The suitability of sweetpotato starch for use in laundering, in comparison with that of various commercial laundry starches, was determined by a consideration of the properties imparted to laundered material after starching and ironing. This study involved the development of physical methods for testing starched materials for stiffness, resistance to folding or creasing, soilability, and degree of starch penetration. Formulas were developed for making from sweetpotato starch a noncongealing starch and other special starch preparations for laundry use.

The three fellowships established by the Chemical Foundation, Inc., terminated in March 1938. Until that time the incumbents continued investigations on a new method for the dehydration of sweetpotatos for storage and on the utilization of sweetpotato flour produced from the dried material. Besides being used primarily as a source of starch for continuous operation of a starch factory throughout the year, dehydrated potatoes when made into flour may find uses as adhesives and as an ingredient of foodstuffs.

CELLULOSE

Fundamental investigations on the chemistry of cellulose were continued, with special attention to the derivatives of glucose and cellobiose, the simpler hydrolytic degradation products of cellulose. The α- and β-methyl-d-glucosides were prepared and purified for use as reference compounds and for further investigation. The α- and β-octacetyl cellobioses were prepared, purified, and used for studies of deacetylation by the barium methoxide method. By means of a modification of the technique described in the literature, the yield of cellobiose by this method was materially increased. The phenylosazone and the osone of cellobiose were made, and the preliminary study of the alcoholysis of cellulose with methyl alcohol-hydrochloric acid mixture was continued. The soluble products are optically active, nonreducing, easily caramelized substances.

MISCELLANEOUS CARBOHYDRATES

Interest in agricultural waste products that are primarily of cellulosic and hemicellulosic nature has brought to the front the problem of extracting hemicelluloses from various plant materials. Therefore, extensive studies of the optimum conditions for extracting hemicellulose from sugar-beet pulp, rice hulls, and peanut shells were made, and the most suitable conditions for extraction with both acids and alkalies were determined. It was found that pectin interferes with extraction of other hemicelluloses (e. g. from beet pulp). When pectin is present the extraction should be carried out at a higher temperature or preliminary extraction of pectin should be performed. The principal constituents of these hemicelluloses are uronic acids and the sugars xylose and arabinose. These two sugars, although sweet to the taste, have little or no food value, but can be used whenever sugars are employed for industrial nonfood purposes.

Sirups of different sugar and dextrin contents were made from fresh sweetpotatoes by varying the time of hydrolysis, the pressure, and the concentration of acid used. Tests by a commercial laboratory showed that some of these sirups were useful adjuncts in the brewing of beer.

Previous investigations in the Bureau have shown that chicory roots are useful as a source of inulin and levulose sirup. Removal of water from the roots is a necessary preliminary step. It was found that by treating the ground roots with carbon tetrachloride vapors 75 percent of the water could be removed by pressing.

OIL, FAT, AND WAX INVESTIGATIONS

VEGETABLE OILS

The report for 1937 described the general characteristics of the oil obtained from the fruit seeds of the Brazilian palm (*Syagrus coronata*), which has recently become of commercial interest. In response to numerous requests for information concerning the composition of this oil, commonly known as ouricury palm-kernel oil, the mixed fatty acids from this oil were investigated and found to contain the following percentages of individual acids: Caproic, 1.66; caprylic, 9.1; capric, 7.64; lauric, 42.7; myristic, 8.43; palmitic, 7.15; stearic, 2.15; arachidic, 0.096; oleic, 12.18; and linoleic, 2.04. This oil, which exists in the seed kernels to the extent of about 70 percent, is well suited for the manufacture of margarine and soaps and for the preparation of mixed or fractionally distilled fatty acids.

The composition of American tung oil was investigated further, special attention being given to its content of linoleic acid. A previous investigation by this Bureau showed that eleostearic acid constituted the bulk of the mixed fatty acids, ranging from 85.5 to more than 89 percent of the total, and that oleic acid and saturated acids were present to the extent of 4 percent or slightly more for each. A report on the composition of Chinese tung oils published by German investigators showed that their mixed fatty acids contained more than 9 percent of linoleic acid and consequently a notably smaller quantity of eleostearic acid than previously reported by this Bureau. Estimation of linoleic acid in the mixed fatty acids from American tung oil by two improved methods indicated that no more than 0.9 percent of linoleic acid was present. The results of these analyses as well as those previously obtained indicate the presence of only a very small percentage of linoleic acid in the tung oils examined. It is believed that authentic tung oil from any locality will contain very small quantities of this acid, unless it has been expressed from decidedly immature seeds.

Preliminary investigations were made on the seed oils of the native tree *Sapindus drummondii* and the foreign tree *Moringa oleifera*. Both the oils were found to belong to the nondrying class. The first exists in the seed kernels to the extent of 43 percent, which represents about 8 percent of the weight of the berrylike fruits. It is rather difficult to recover because the kernels adhere firmly to the tough, thick seed coats and the oil must be expressed or extracted with solvent from the undecorticated seed after crushing. The second exists in the seed kernels to the extent of 49.2 percent, which represents about 35 percent of the combined weight of kernels and hulls.

The investigation of *Sapindus drummondii* as a possible source of oil was undertaken at the suggestion of the Soil Conservation Service. The fruits were collected in Oklahoma. Seeds of *Moringa oleifera* were received from Nicaragua, through an individual in Texas who was interested in the possibility of growing these trees on a commercial scale in the warmer parts of that State for the production of oil. These trees are reported to thrive on relatively poor soils, and if it is found feasible to grow them for oil production from their seeds it is proposed to plant them in soils not adapted to the production of other crops. They grow rapidly under favorable conditions and are reported to yield seeds when but 3 or 4 years old.

WAX FROM LEAVES OF DOMESTIC PALM

A preliminary investigation was made on wax from the leaves of the palm *Serenoa serrulata*, which is indigenous to southern Florida. This investigation was suggested by botanists in the Bureau of Plant Industry, who supplied a small sample of crude wax obtained from the dried leaves. The wax, originally in the form of a gray powder, was separated from plant debris by dissolving in hot chloroform, filtering, and evaporating, after which it was a hard, brittle, yellowish-brown solid. It softened at 75° and melted at 82° C. Tests indicated that it was a true wax somewhat similar to carnauba but contained slightly more uncombined acid and had a higher saponification value.

RESEARCH METHODS

Incidental to the investigations on vegetable oils, studies were made to determine the adaptability and dependability of several analytical procedures, including the volumetric titration of mixed fatty acids in cold alkaline solution with a very dilute standard solution of potassium permanganate, previously devised by this Bureau, the Meinel color reaction for the detection of conjugated double bonds, three procedures for determining unsaturated acids having conjugated double bonds, and application of the Bertram permanganate oxidative procedure to the qualitative and quantitative determination of unsaturated acids in ethyl ester fractions prepared directly from vegetable oil.

FOOD RESEARCH

CITRUS FRUIT PRODUCTS

The Texas Citrus Products Laboratory cooperated with 40 commercial firms, including grapefruit canneries, citrus-product manufacturers, and equipment manufacturers, on problems relating to canning methods, control of quality, aging, oil recovery, new products, and disposal of wastes. Methods of handling tender and pink grapefruit sections so as to preserve color and form were demonstrated to canners entering this field. Several formulas for marmalade bases were developed for a manufacturer, and a new formula was developed for making spice-flavored citrus-fruit butter. It is believed that the manufacture of this product, which has been undertaken by two firms, will provide a desirable outlet for the pulp separated from juice intended for canning. Methods for preparing bases for dry and sweet carbonated grapefruit beverages were demonstrated to several prospective manufacturers who contemplate beginning commercial production next season, using methods developed by the Bureau.

A method for estimating the peel-oil content of grapefruit juice extracted by various methods was developed and applied. Because of the general introduction of automatic extraction equipment, this work was of value to canners in judging the suitability of each type of such equipment.

In preparing different blends of juices from frost-injured California oranges and grapefruit, it was found that the addition of about 5 percent of lemon juice overcame to some degree the flat taste characteristic of juice from frozen fruit.

Orange juice up to 35 percent by volume gave increased sweetness and body to the mixtures. A blend of equal volumes of orange and grapefruit juices with 5 percent of lemon juice proved very satisfactory. The bitter taste of canned navel orange juice is well masked in mixtures with grapefruit juice.

A preliminary study was made of the cause and prevention of bitterness in navel orange juice on standing, with particular attention to the enzyme factor. As yet no explanation has been found for the formation of the bitter substance. This problem is of great importance to the orange growers of California because if this bitterness can be prevented commercial use can be made of the juice of navel oranges, which up to the present has not been possible.

Further experiments were made on the canning of various citrus fruits for table use and ice-cream toppings and of mixed citrus fruits for use as salads. The results indicated that a good commercial product can be made by canning navel oranges if care is taken to select well-matured fruit. The ice-cream toppings made from tangerines and mandarin oranges seem to have definite commercial possibilities. Blood oranges also made a pleasing product.

During the year special apparatus was devised and used satisfactorily for direct determination of carbon dioxide, oxygen, and nitrogen in citrus juices in studying the gas content of fresh juice prepared in different ways, of deaerated juice, and of processed juice. It was found that deaerators being used commercially in Florida remove only about 34 percent of the oxygen in fresh juice. Juice deaerated in the laboratory by means of the improved equipment recently developed by the Bureau contained only one-tenth as much oxygen as did juice deaerated commercially. One packer has installed this type of deaerator, and tests will be made under commercial operating conditions.

A jellied grapefruit juice was prepared by adding edible gelatin (4.5 percent by weight) to grapefruit juice, dissolving it by heating gently, and then processing in the usual manner. At room temperature the juice is liquid, but upon chilling it solidifies so that the housewife may simply cut the top from the can and remove the jellied juice for salads. It is important to use gelatin of the finest grade in order to prevent objectionable odor and taste.

Owing largely to the preliminary research carried out at the citrus-products laboratories, small-scale commercial production of grapefruit-seed oil has been started in Florida. During the first season of production (1937–38) the output amounted to about 10,000 pounds. The oil is expressed from the cleaned and dried seeds and after settling is pumped through a plate-and-frame press. Examination of the press cake showed that less than half the oil is recovered. Obviously this is owing to the fact that the seed hulls not removed prior to pressing absorb and retain a large part of the oil.

The Texas Citrus Products Laboratory cooperated in studies of methods for reducing the cost of producing dried citrus meal and improving the quality of the product, handling sewage from canneries and dehydration plants, and converting citrus cannery waste to marketable fertilizer. Definite contributions were made toward the solution of the first two problems; work is still in progress on the third.

The Florida Citrus Products Laboratory cooperated with the Florida Canners' Association and the Florida State Board of Health in efforts to solve the serious problem of innocuous disposal of liquid effluents from citrus fruit canneries. Analyses of the effluent from different canneries were made throughout the canning season. The effluent from canneries packing grapefruit sections was more concentrated than that from canneries packing juice. After encouraging laboratory experiments on the treatment of cannery effluents by a biological process applied by means of an intermittent or trickling filter, the Florida Canners' Association provided funds for the erection of an experimental treating plant. The plant, which was designed by the Florida State Board of Health, was not completed until the end of the season, but during the very short time that it was in operation as much as 68-percent reduction in biological oxygen demand of the sewage was obtained when the filter was dosed at the rate of 1,566 000 gallons per acre per day. The time available did not permit experimenting with higher doses.

APPLE PRODUCTS

Further studies on the technology of canning apple sauce showed that sauce of satisfactory quality can be made commercially from western-grown apples. The yellow color of sauce from many of the western-grown varieties is not objectionable so long as it has a bright tone. The principal requirement for a bright, uniformly colored sauce was found to be rapid handling with minimum exposure to air after peeling.

It was found possible to lighten the color of apple sirup through the bleaching effect of sulphur dioxide. Sulphur dioxide resulting from sodium bisulphite added to the apples at the time of grinding is largely eliminated during concentration of the juice. Lighter-colored sirups and better flavor also result if the sulphurous acid is neutralized after, rather than before, concentration.

Apple powder is used to some extent, especially in foreign countries, in the treatment of intestinal disorders. To assist in studies designed to explain the therapeutic effect of apple powder a substantial quantity of galacturonic acid, the essential unit in the development of pectic substances, was prepared and supplied to the school of medicine of the University of Oregon for use in experiments with animals. Improvement in the method of producing this compound by enzymic hydrolysis of polygalacturonic acids has greatly reduced the cost of preparation, and the material should now be readily available to research workers and possibly for other uses.

MISCELLANEOUS FRUIT PRODUCTS

It was found that the juice from California-grown Black Tartarian cherries can be satisfactorily preserved for at least 18 months by preheating to 194° F., cooling, treating with a commercial clarifying agent, decanting after settling, filtering after addition of a filter aid, pasteurizing at 174° to 178° and sealing in charcoal-plate lacquered cans under vacuum. Bottles are not so good as cans for containers because the juice has a tendency to fade on exposure to light. The yield of juice was about 145 gallons per ton of fruit.

In cooperation with the Washington State Agricultural Experiment Station, canning experiments were made on freestone peaches grown in the Yakima Valley to determine the relative suitability of different varieties for commercial canning. Packs with satisfactory color, flavor, texture, and general appearance were obtained with J. H. Hale, Gold Medal, Elberta, State Champion, and Early Elberta varieties, while Up-to-Date, Slappey, Shalil, Rochester, Early Crawford, and Late Crawford varieties yielded products of either poor texture or ragged appearance. In collaboration with the Bureau of Plant Industry, canning experiments were also made on about 30 lots of peaches as an aid in the selection of improved varieties of canning peaches for commercial production in southern California.

Examination of experimentally canned Young dewberries after 2 years of storage at room temperature showed that they kept better in charcoal-plate enamel cans than in coke-plate enamel cans. One-fourth of the cans of the former type were still in good condition, whereas all of those of the latter type had developed into springers or swells. Holding at 38° F. lengthened the storage life of the canned berries; no swells could be detected in any of the lots stored at that temperature. Examination of canned Boysen dewberries after 1 year of storage also showed that the charcoal-plate cans held up better than the coke-plate cans and that storage at 38° was much better than storage at room temperature.

In cooperative work with the Food Products Industries Department of Oregon State College, undertaken to determine the best procedure for the extraction, clarification, and preservation of juices from blackberries, Logan blackberries, raspberries, and dewberries, it was found that cold pressing fresh berries resulted in low yields and poor quality of juice. Pressing berries that had been heated with constant stirring until they began to disintegrate gave yields of juice ranging from 65 to 70 percent. Such juice was judged to be far superior to cold-pressed juice, and the yield averaged 20 percent higher. Heating at a temperature of from 150° to 160° F. produced the best yield and minimum loss of flavor. Frozen-pack berries, pressed after defrosting, yielded 65 to 70 percent of juice equal or superior in quality to heat-extracted juices from fresh fruit. The use of a basket-type centrifuge produced 70 percent of juice from defrosted frozen-pack berries.

The juices from fresh or frozen-pack berries were found to be clarified satisfactorily by treating them at 100° F. with a commercial enzyme preparation (1 pound to 100 gallons) to precipitate pectinous material, allowing them to settle for 3 or 4 hours, adding bentonite (about 1 gram per gallon), and then allowing them to settle for an additional hour. The clear juice, separated from the flocculent precipitate by siphoning, was deaerated, flash pasteurized at 200°, cooled, and filtered. Berry juices clarified by this process were found to be ideal for making jelly. They were too tart to be used directly as fruit drinks, but were in good condition for bottling or canning, the product to be diluted and sweetened by the consumer.

Freshly extracted berry juices were canned satisfactorily by merely straining through cloth, deaerating, flash pasteurizing at 190° to 200° F., filling and sealing the cans while the juice was hot, and cooling them in cold water. Some sediment formed in juices packed in this manner, but the flavor was well preserved.

Efforts to discover the cause of sediment formation in apple juice after clarification were unsuccessful. It is hoped that further studies on the behavior of pectinase enzymes will reveal some clue. Experimental results showed that apple juice can be preserved satisfactorily by clarifying the expressed juice by pectinase enzyme treatment, filtering, flash pasteurizing, sealing in special enameled cans while hot, and cooling the cans rapidly.

The rapid evaporator recently developed by the Bureau was used for preparing concentrated juices and sirups from apples, pears, and cherries. The use of this improved evaporator offers distinct advantages over vacuum-pan concentration in that juices can be concentrated to a higher degree without caramelizing and without the development of a cooked taste. Sweet cherry juice was found to have an attractive color but was somewhat lacking in flavor and developed a bitter taste during storage.

Experiments were made on the dehydration of cull cantaloups and honeydew melons for use as stock food. The flesh (with rind) and contents of the seed cavity were ground and dried separately in a semicommercial dehydrator. Since the seeds are a component part of the material prepared from cavity contents, the product is higher in fat than most other stock foods made from fruits and vegetables. It is also fairly rich in protein and sugars. The material prepared from flesh and rind is low in protein and almost free from fat but has a high sugar content. Some difficulty was caused by stickiness of the concentrated material, but it was found that this could be eliminated by starting with a half-and-half mixture of cantaloup and alfalfa meal and adding more cantaloup repeatedly as evaporation proceeded. Mixtures containing as high as 85 percent of cantaloup solids were obtained in this way. Drying tests on a large scale and feeding tests with farm animals will be required to determine whether the use of cull melons for this purpose is commercially feasible. It has been estimated that about 75,000 tons of cull melons are wasted every year. This quantity would yield nearly 15,000 tons of dry materials; therefore the problem is of some economic importance.

FROZEN-PACK INVESTIGATIONS

Largely as the result of experimental work by the Bureau which demonstrated the commercial possibilities of preserving fruits and fruit pulps by quick freezing for desserts and for use in ice creams and sherbets, a beginning has been made in the commercial packing of frozen fruit products. Recently frozen nectarine and other fruit pulps have appeared on the market. There is a gratifying manifestation of increased interest in frozen fruit pulps, and it is believed that the industry will continue to grow.

Experiments on the freezing preservation of new varieties of fruits were made at the Corvallis, Seattle, and Pullman laboratories to aid horticulturists of the Bureau of Plant Industry and the State agricultural experiment stations in their selections of varieties for commercial production, especially for the frozen-pack industry. Different varieties of raspberries from the Western Washington Experiment Station which had been under test for several years were given a final classification on the basis of quality and suitability for frozen pack. Three varieties were classed as excellent, five as good, five as fair, and three as poor. One variety that was classed as excellent, and another as good, have been named Washington and Tahoma, respectively. They are described in Popular Bulletin 153 of the Western Washington Experiment Station, which gives credit to the Seattle laboratory of this Bureau for participating in the determination of their frozen-pack quality.

In preliminary work on fruits grown at the Prosser Irrigation Branch Experiment Station it was found that frozen-pack plums generally had a very pleasing appearance, and most of them had good color and texture. The major problem is the apparent toughening of the skin, which may be caused by dehydration of the subepidermal tissues due to early ice formation in the inner flesh of the ripe fruit. Sweet cherries gave very satisfactory frozen packs, as did peaches and most of the apricots. Wenatchee, Moorpark, and Hemskirke apricots were not so satisfactory for frozen pack. Owing to unwise promotion and planting, these varieties constitute the major surplus problem. Both in

canning and freezing the uneven ripening of the fruits is an almost unsurmountable barrier to the production of a high-quality product.

Frozen-pack peaches and other light-colored fruits become brown on the surface due to oxidative enzyme action. Browning develops mostly while the packed fruit is being cooled to freezing temperatures and during defrosting preparatory to utilization. It was found that the practice of steam scalding to facilitate removal of the skins stimulates subsequent browning, especially in the case of immature fruit when scalding is prolonged. Rinsing with fresh cold water after peeling and after slicing and rapid cooling help to prevent browning. Covering the surface of the fruit in the packages with disks of closely adherent, compact, and flexible cellulose sheet material is also helpful. Treatment of sliced peaches with 0.25- and 0.5-percent hydrochloric acid solutions for 2 or 3 minutes, followed by a fresh-water rinse before packing, and treatment with low concentrations of cysteine hydrochloride (2 or 3 parts to 1,000 parts of water) for short periods before packing were the most effective of the chemical treatments tried for preventing or lessening oxidative browning during defrosting. The former treatment delayed discoloration for 2 hours and the latter for 6.

Technological experiments on the freezing preservation of vegetables were made at the Los Angeles laboratory of fruit and vegetable chemistry in cooperation with the Fruit Products Division and the Home Economics Division of the University of California, the Division of Agronomy and the Truck Crops Section of the California College of Agriculture, and the California Consumers Corporation. Frozen packs were made of lima beans, peas, asparagus, brussels sprouts, broccoli, squash, and sweet corn. As a result of experiments on lima beans of different varieties grown on 156 plots under differing climatic conditions in California, a selection was made of commercial varieties best adapted to freezing on the basis of yields for 1 year and of freezing and cooking qualities. Cooking tests on asparagus frozen after truck transportation for 350 miles under ice refrigeration showed that it was equal to the product frozen immediately with solid carbon dioxide at the time and place of harvest. Asparagus frozen after similar transportation without ice refrigeration was inferior. Preliminary cooking tests on broccoli frozen shortly after harvest and after transporting 100 miles by truck, with and without refrigeration, showed that there was practically no difference in quality of the three lots.

Freezing experiments in cooperation with the Western Washington Experiment Station showed that, from the standpoint of quality of the frozen product, varieties of garden peas that have green-skin wrinkled seeds are well adapted to cold packing. Varieties that have green-skin, dimpled, or round seeds are poorly adapted to cold packing, and those that have pale-skin seeds are unadapted to cold packing. Varietal differences in skin texture, color, and flavor are sufficiently pronounced to permit selection within the well-adapted group. Consideration of cultural factors and quality of frozen pack has led to the selection of 26 varieties, out of all studied, as either well adapted or worthy of trial for commercial freezing in western Washington.

Quality in frozen snap beans is largely dependent on absence of strings and fibers and the retention of desirable form, texture, and color during cooking. Of the varieties studied, those that appeared best adapted include the following: White Creaseback (Blue Lake), Kentucky Wonder (Old Homestead), and White Seeded Kentucky Wonder, green pole varieties; Asgrow Stringless Green Pod, Burpee Stringless Green Pod, Tendergreen (New Stringless Green Pod), Giant Stringless Green Pod, Landreth Stringless Green Pod, Full Measure, Asgrow Stringless Valentine, and various strains of mosaic-resistant Refugee, bush green pod; Round Pod Kidney Wax and Keeney Stringless Kidney Wax, bush wax pod.

Both bush and pole varieties of lima beans differ markedly in adaptability to freezing from a quality standpoint. Green seed coats at freezing stage, tender texture, and high flavor are important requirements. Henderson Bush, which is now frozen commercially, is inferior in color and texture to several varieties having large, green seeds.

The best varieties of sweet corn for freezing on the cob are those having fairly uniform ears 6 inches or more in length, 1½ to 1¾ inches in diameter, and cylindrical or only slightly tapered in shape. Golden Bantam and its hybrids are among the best.

Cooperative experiments were made on the freezing of vegetables grown at the Prosser Irrigation Branch Experiment Station. As a result, selections were made of varieties of peas, snap beans, lima beans, and sweet corn best

adapted to this district. Only peas of the earliest varieties were suitable for frozen pack. Because the high atmospheric temperatures caused rapid aging at maturity, it was difficult to harvest and process peas to good advantage. It is doubtful, therefore, whether the Prosser district will ever prove suitable for commercial production of garden peas.

In order to obtain information regarding the proper stage of maturity for harvesting sweet corn for preservation by freezing, Golden Bantam corn was harvested on successive dates and put up by frozen-pack methods. Observations and chemical examinations will be made of the samples after storage. Experiments have shown that the qualitative test for peroxide can be substituted advantageously for the catalase test as a criterion of sufficient scalding in sweet corn being prepared for freezing. The catalase test is likely to be inaccurate, especially on corn in advanced stages of maturity.

Experiments made to determine the relation of temperature and time of scalding to the formation of split and wrinkled peas revealed that scalding temperatures were not significant for the formation of split peas until they reached or exceeded 200° F. At 200° and above the proportion of splits formed increased with the period of exposure. Wrinkling of scalded peas first became apparent when the temperature was 200° and the period of exposure was 2 minutes. Studies on the comparative effects of boiling water and steam scalding on the production of split and wrinkled peas have so far been inconclusive.

Efforts are being made to develop suitable methods for determining maturity and quality of peas intended for freezing. Examination of peas subjected after scalding to a so-called quality grading by brine separation and centrifuging showed that such grading is of doubtful value, especially when peas of suitable maturity are properly harvested and handled.

Samples of pea wastes from several frozen-pack establishments were taken and are being held in freezing storage. They will be analyzed to determine possible utility.

The results of 3 years' work on the microbiology of frozen fruits and vegetables were published. Types of micro-organisms and the numbers of each present were listed for the fresh materials going into the frozen packs as well as for the frozen products at various stages. The data should be useful in providing standards of purity for frozen-pack products of the kinds tested, which included blueberries, strawberries, green beans, lima beans, sweet corn, spinach, and kale.

Microbiological studies on experimental frozen packs of cultivated blueberries were completed. The data, which show the effects of two different methods of washing fruit, of several ways of packing, and of two storage temperatures, add to available knowledge regarding the survival of micro-organisms at freezing temperatures and should be of value to packers who desire to put out high-quality frozen fruit.

Microbiological tests on commercial cartons of frozen-pack peas removed from storage at 0° F. and held at higher temperatures before opening showed that microbial activity increased with temperature. At 70° the peas were definitely fermented in 24 hours or less, presenting a uniformly bleached appearance and emitting a strong sour odor. At 40° no significant microbial activity was apparent until at least the fourth day. At 34° the time required for bacteria to affect the quality of the product was extended to over 9 days, and at 28° the peas were still acceptable after 21 days. The predominating organisms in peas spoiled at 70° were lactobacilli. In peas held at 40° *Lactobacillus*, *Achromobacter*, and *Pseudomonas* were active. The principal organisms multiplying at 34° and 28° were *Achromobacter*, *Pseudomonas*, and *Flavobacterium*, with some "pink" yeasts (*Torulae*).

Experiments showed that some of the organisms naturally present in peas survive unusually long periods of scalding. Peas scalded for 8 minutes before freezing, after storage for 9 months at 0° F. soured rapidly when held in the sealed cans at 70°.

Microbiological studies were made on frozen fruits and vegetables to determine whether microbial distribution and destruction are uniform throughout the contents of a given container as well as the factors involved. This work was undertaken with the hope that the results might reveal some of the factors responsible for microbial survival at subfreezing temperatures and so contribute findings applicable to the preparation of frozen foods of low microbial count. Liquid and partly liquid packs were frozen in still air and stored at subfreezing temperatures. Under the experimental conditions, redistribution of microbial forms,

other suspended particles, soluble solids (sucrose, sodium chloride, total acids), and hydrogen ions was demonstrated. Solid and dissolved substances interfered with the degree of microbial concentration and with the redistribution pattern. Increase in concentration of some substances was favorable for microbial survival, while increase in concentration of other substances was unfavorable. Redistribution of dissolved and solid substances in a liquid medium during freezing establishes different environmental conditions within the frozen mass. Whether these environmental conditions do or do not favor microbial survival is of great significance in the preservation of foods by freezing.

VEGETABLE PRODUCTS

Studies relating to commercial production of cucumber pickles were continued at Raleigh, N. C., in cooperation with the North Carolina Agricultural Experiment Station. It was found that under southern climatic conditions cucumbers can be cured at low salt concentration, 5 percent for 1 week increased by 2 percent each week up to 15 percent, without decrease in quality of stock. Results with initial salt concentrations of 10, 15, and 20 percent were not so good. Lactic acid formation by the fermentation of sugars was most rapid and complete in the 5-percent brine, resulting in a shortening of the time required for curing. Moreover, fewer hollow cucumbers were obtained with 5-percent than with 10- or 15-percent brine.

The manufacture of genuine dill pickles under southern climatic conditions is usually accompanied by much spoilage. Efforts are being made to work out satisfactory methods for their production. Rolling the barrels occasionally during the first 10 days of curing to maintain a uniform salt concentration was found advisable. Addition of vinegar to the brine improved the stock. No benefit was noted from addition of lactic acid or sugar or from washing the cucumbers.

A pasteurization procedure was developed for fresh cucumber pickles which makes the slices retain their crispness to a high degree, avoids continued cooking, and prevents spoilage. A temperature of 160° F. for 20 minutes, followed by quick cooling, was found satisfactory for the production of a high-quality product.

Studies were made on the suitability for commercial canning of vegetables grown under irrigation in the lower Yakima Valley under conditions similar to those that would obtain in the proposed large Columbia Basin irrigation area. These studies indicated that garden peas satisfactory for canning cannot be produced in this area. Lima beans, however, yielded a good canned product. Further work is necessary to corroborate the findings of preliminary experiments, since some varieties that are more or less standard failed to show up as well as other newer or less well-known varieties.

In a study of methods for preparing carrot juice the procedure found to be most satisfactory included washing, lye peeling, quartering, steam blanching, fine grinding, and processing at 245° F. for 20 minutes.

In cooperation with commercial lettuce growers and shippers, experiments were made on the dehydration of cull lettuce, consisting of loose heads and trimmings, for possible use as a stock food. The dried product, reduced to about one-tenth of the original weight, had good color, aroma, and taste, with a moisture content of about 10 percent. Deficiencies of certain food values in dried lettuce could be remedied by supplementing it with other feeds. Experiments on a larger scale and animal-feeding tests are necessary to determine the commercial feasibility of dehydrating cull lettuce for stock food.

STALING OF BAKERY PRODUCTS

Recent experiments in the Bureau indicate that during the staling of bread there is not only a decrease in the proportion of soluble starch but also an increase in the proportion of soluble nitrogenous compounds. Bread 3 days old contains more than twice as much of such compounds as bread 1 hour old. The change in proportion of soluble nitrogenous compounds is relatively larger than that of soluble starch. The changes in both after 6 days are not appreciably greater than those after 3 days, indicating that staling takes place most rapidly during the first 3 days after baking.

Bread made with wheat flour containing a small proportion of rye flour, gelatinized rice flour, gelatinized potato flour, taro flour, or dried apple showed somewhat better keeping qualities than ordinary bread. Experiments on the

cold storage of bread and cake indicated that this is an effective means for retarding staling which might be of practical importance in emergency cases. Bread stored at 0° F. for as much as 4 months showed, when thawed out, the characteristics of bread 1 day old. When thawed out, cake similarly stored for 10 months was judged equal in quality and freshness to cake 1 day old. It was found that, contrary to the general belief, the storage of bread in an atmosphere containing formaldehyde did not retard staling.

RANCIDITY

Experiments in the Bureau showed that the enzyme catalase is somewhat effective in keeping oil-bearing foods from becoming rancid but not so effective as the exclusion of all light or light of wave lengths delimited by 4,900 to 5,800 angstrom units. Catalase-bearing products, such as oat flour, rice bran, rice polish, and nuts, remained free from rancidity so long as the catalase was potent. Since catalase is destroyed by high temperatures, care should be taken that the temperature does not exceed 60° C. when catalase-bearing products are heat treated for the purpose of destroying insects and insect eggs.

It was found that when vegetable oil was stored in contact with copper it became rancid regardless of whether the oil was exposed to light or kept in the dark.

A theory has been devised which accounts more fully than any previous one for the various phases in the development of rancidity in vegetable oils. It assumes that free hydrogen is liberated from the chlorophyll present in the oil, that this hydrogen unites with molecular oxygen to form hydrogen peroxide composed of two loosely combined OH groups, and that these OH groups become attached to the unsaturated bond of the glyceride, thus giving rise to the rancid compound. If this is true, the chlorophyll under the photochemical action of light acts as a photosensitizer and liberates free hydrogen. Since metals in contact with vegetable oils are known to produce hydrogen peroxide and to catalyze rancidity, it is logical to believe that they produce active hydrogen peroxide of the same nature as that produced by the action of light in the presence of a photosensitizer. The rancidity "induction period" of an oil or fat may therefore be defined as the time required for the photosensitizer, always present in oils and fats, or metal catalyzer to develop the reactive substances to a point where rancidity is recognized by taste and odor.

MINERAL ELEMENTS IN FOOD PRODUCTS

The effects of boron, copper, manganese, zinc, cobalt, nickel, iodine, selenium, and nitrate nitrogen on the stimulation or depression of diastatic power were determined by a new procedure, developed in the Bureau, for studying malts on a small scale. While some of these elements depressed and others stimulated germination and growth, none had any appreciable effect on the diastatic power of barley malts.

A new method was developed for determining phosphorus in cereal seeds and other plant materials the ash of which has an acid balance.

Research on plant mineral constituents derived from soils and their relation to the soils on which the plants are grown, and to crop, animal, and human nutrition and health was continued as a project under the Bankhead-Jones Act of June 29, 1935, which provides for basic research in agriculture. The results of a survey of world literature and of unpublished data submitted by State agricultural experiment stations indicated that no systematic attempt had ever been made to discover the relation between the wide variation in the mineral content of crops and soil composition, soil treatments, and environmental factors. Although there is convincing evidence in the literature that soil composition does influence the health and well-being of man and other animals, no systematic study has ever been made of the role played by available soil minerals in influencing the healthfulness and composition of plants, the possibility of modifying the mineral content of plants through soil management and treatment, the relation of plant composition to animal disease, and the relation between mineral nutrition of crops and the commercial or nutritive value of such crops.

Data are now available regarding the mineral content of over 100 crops, particularly with regard to the more commonly occurring minerals. These are being tabulated so as to correlate the occurrence of certain deficiency diseases with the mineral composition of the crops consumed by the animals.

CALIFORNIA WALNUTS

Studies were continued on the effects of ethylene and other gases on loosening the hulls of walnuts, on the causes of lowering the color grade of the kernels, and on methods for determining the maturity of walnuts. In both laboratory and plant experiments to determine the effect of carbon dioxide in the ethylene treatment for loosening the hulls of walnuts, it was found that carbon dioxide up to 3 percent did not cause darkening of kernels nor retard hull loosening. Additional experimental evidence was obtained that there is marked deterioration in kernel color when mature walnuts in the hull are left lying on the ground exposed to hot sunshine. Neither field-hulled nor ethylene-treated walnuts showed any deterioration in kernel color after storage for 7 months.

Research on loosening the hulls of mature sticktight walnuts was practically completed, except for the assembly of data and preparation of the final report. This investigation resulted in a satisfactory commercial method in which ethylene gas is used in low concentrations. Before the introduction of this method growers had much difficulty in removing the hulls from this type of nuts. If harvesting was delayed until the hulls loosened naturally, the color of the kernels deteriorated, especially in the hotter, interior districts of California, with consequent financial loss. This method is of great economic value to walnut growers in these districts.

PHYTOCHEMICAL INVESTIGATIONS

The waxlike coating of grape skins, 7.4 percent of which was extracted with ether from air-dried pomace of Concord grapes, was found to contain the sapogenin oleanolic acid, together with glycerol, unsaturated fatty acids (oleic and linoleic), saturated fatty acids (palmitic, stearic, and higher members of the same series), hydrocarbons (nonacosane and hentriacontane), sitosterol, a mixture of primary alcohols of the series C 22 to C 28, and unidentified resinous substances. Grape pomace is an inexpensive and readily available source of oleanolic acid. This compound and also the closely related compound ursolic acid, which the Bureau previously found exists abundantly in the coating of apples and other fruits, is of much interest to organic research chemists and may have some practical uses.

In order to gain a better understanding of the natural synthesis of oils and fats, the Bureau has undertaken a fundamental study of the naturally occurring fatty acid glycerides which is dependent upon their isolation and purification without alteration or decomposition. The new method of molecular distillation seemed to offer a means for isolating oils and fats in their original condition, which heretofore has been very difficult to accomplish. In order to determine the actual value of this method for the purpose in mind, experiments were made on the preparation and molecular distillation of synthetic glycerides. A fairly satisfactory method was developed for the purification of oleic acid, the product being 99 percent pure. A preliminary synthesis of triolein was made, and the product appeared to be capable of molecular distillation without decomposition. Linoleic acid was prepared in a pure state from its crystalline bromide and was used in a preliminary study of the factors involved in its conversion to the beta form. The saturated glycerides, tristearin, tripalmitin, trimyristin, and trilaurin, were successfully purified by molecular distillation with the pot still.

It is believed that more definite knowledge as to the identity and composition of the various glycerides as they exist naturally in oils and fats will be of value in solving problems connected with the breeding of oil-producing plants, the utilization of such plants and their seeds, the deterioration in storage of oils and fats and foods containing them, and the digestion and assimilation of oils and fats by animals.

Fruit of the Amur corktree (*Phellodendron amurense*), submitted by the Division of Research of the Soil Conservation Service, was found to contain a volatile oil which consists mainly of myrcene (about 92 percent) with *n*-methyl nonyl ketone and apparently a little geraniol. Steam distillation yielded 2.2 percent of oil from the green and 3 percent from the ripe fruit. No use has yet been found for the oil. Material extracted from the residue left after steam distillation had a peculiar physiological reaction on the tongue and lips, causing a lasting tingling sensation. Preliminary tests on a sample submitted to the Bureau of Entomology and Plant Quarantine indicated that the extract may have some value as an insecticide.

PLANT VIRUSES

The Bureau continued to cooperate with the Bureau of Plant Industry in the study of plant viruses, a project conducted under the Bankhead-Jones Act of June 29, 1935, providing for basic research in agriculture. In a study of the trypsin method of virus purification it was found that mosaic virus and other proteins in tobacco can be distinguished by their different behavior toward trypsin and at least partly separated. As a result, it was possible to measure for the first time the virus and nonvirus proteins in the plant tissue itself instead of in incomplete extracts. Such measurements showed that the virus protein is not produced independently in very abnormal quantities, as was generally supposed. Instead, the virus protein occurs in relatively small proportion to the total protein and largely at the expense of nonvirus proteins. This fact may change existing ideas about the mechanism of virus-protein formation. The ratio of virus to total protein varies, however, in favor of the latter with the age of the plant and presumably with recovery from the mosaic disease. It was found, also, that the virus exists within the plant cells rather than in the fluid surrounding them.

A study of the amylase activity in leaves from normal and mosaic tobacco showed that virus causes a general disturbance of the plant's metabolism but did not indicate its mode of action, since virus protein had no effect on amylase directly.

PRESERVING BIOLOGICAL SPECIMENS

Fundamental research on methods for preserving specimens of organic materials related to agriculture in as nearly a natural condition as possible was carried on during the year as a project under the Bankhead-Jones Act of June 29, 1935, providing for basic research in agriculture. Methods for preserving agricultural specimens, such as roots, stems, leaves, flowers, fruits, and seeds of plants, and insects so that they will retain their natural color and shape for an indefinite period are highly desirable. Investigations were made on two interrelated processes that offer great promise of meeting the ideal requirements for the preservation of agricultural specimens. In one process fresh plant materials are treated chemically in such a manner as to toughen the tissues and set the natural color, after which they are treated with a transparent preservative substance and mounted directly on glass plates or between transparent films of cellulose. In the second process, the specimens, after preparatory treatment, are imbedded in transparent plastics of the methacrylate type while in the fluid state. This method permits the specimens to be encased without deformation in a solid, highly transparent, and nearly colorless substance which may be machined and polished. A number of plant and entomological specimens, preserved and mounted by these methods, were put on exhibition. While they attracted much interest and were the subject of much favorable comment, it should be pointed out that the preservative processes are still in the experimental stage, and a number of undetermined factors relating to their use and the permanence of results remain to be studied.

PHARMACOLOGICAL INVESTIGATIONS

Pharmacological studies on inorganic substances that may contaminate foods were concerned with the possibilities of chronic poisoning by cadmium and antimony. Cadmium administered in the form of chloride was found to be distinctly toxic to albino rats, even in concentrations as low as 30 parts per million parts of diet. At concentrations of 60 parts per million and above, it resulted in anemia, retardation of growth, cardiac hypertrophy, and occasionally in death. When rats receiving 120 parts of cadmium per million parts of diet were returned to a normal diet, the anemia disappeared and the normal rate of growth rapidly returned. Studies are still in progress on the distribution of cadmium stored in the tissues and evidence of injury as revealed by histological examination. Antimony administered in metallic form, as trioxide, and as pentoxide appeared to be without toxic effects in concentrations up to 2,560 parts per million. However, antimony in the form of potassium antimony tartrate caused death in 14 days when fed in the concentration of 2,560 parts per million. Preliminary to a study of the distribution of antimony stored in the tissues, work was done on the development of satisfactory colorimetric methods for the determination of antimony and also of arsenic, with which antimony is frequently contaminated.

Studies relating to the therapeutic use of phenothiazine in the treatment of infectious cystitis and pyelitis were completed, and the results prepared for publication. Phenothiazine, the value of which as a urinary antiseptic was unexpectedly discovered in a previous investigation on the pharmacology of this new insecticide, is proving to be not only a valuable aid in therapeutics, but promises to be useful to the veterinarian in the treatment of infections of the urinary tract in cattle.

The results of toxicological studies of derris were published. They indicated that further studies of a wider scope are needed before derris or any of its derivatives may be pronounced wholly innocuous when present in minute quantities on fruits and vegetables subjected to dusting or spraying with insecticides containing such material as the active ingredient.

Studies on the pharmacological and physiological effects of the glucosides naringin and hesperidin, which occur naturally in grapefruit and oranges, respectively, yielded no evidence that these compounds are injurious as food constituents.

Ursolic acid, which occurs naturally in the waxy coating on apples, and its sodium compound were found to have a negligible degree of toxicity and no diuretic effect.

ENZYME INVESTIGATIONS

In continued studies on the enzymic break-down of thick egg white, a recognized indication of deterioration in stored eggs, it was observed that the liquefaction of the thick white in the shell and that in the broken-out eggs are different chemical processes, liquefaction in the shell being more rapid. The Bureau of Animal Industry found that the rate of liquefaction in the shell is influenced by the strain of chickens producing the eggs. This Bureau found, however, that the rate of liquefaction is not proportionate to the amount of mucin laid down in the egg to start with, and must depend on the activity of some liquefying mechanism in the egg that has not yet been satisfactorily explained.

The inhibitor of proteolytic enzyme action in egg white was concentrated and studied with regard to its relation to the preservation of egg quality and to the indigestibility of raw egg white. The inhibitor itself is destroyed by pepsin, so it seems impossible that it should prevent digestion. On the other hand, it appears to play a part in keeping egg white from deteriorating.

A new method was devised and patented for converting the foam from vats of fermenting egg white into usable material. Upon being treated with pepsin the foam liquefies and can be dried in the usual manner.

Measurement of the surface area of broken-out egg white by means of special apparatus was found to provide a possible means for testing the efficiency of bulk grading methods. A statistical treatment of the results of such measurements is being prepared for publication.

An accurate and rapid method for determining the enzyme papain was developed. This method, which is based on the ability of papain to clot milk, has already been widely adopted in laboratories handling papain and such papaya products as meat tenderizers. An up-to-date bibliography on papain and bromelin was prepared.

Crystalline papain was prepared in the laboratory, and a study of the properties of this pure enzyme is still in progress. This is the first enzyme that has been successfully crystallized in the Department of Agriculture.

RETARDING DETERIORATION OF EGGS

Experimental work on treatments to retard the enzymic deterioration in the quality of shell eggs during cold storage was completed. Grading tests were made by the Bureau of Agricultural Economics on a 400-case lot shipped to New York by a cooperating commercial firm early in 1937 and held in cold storage for 6 months. The eggs in 100 cases were untreated; the same quantities had been machine-dipped in plain oil, machine-dipped in carbonated oil, and oiled by the Bureau's vacuum-carbon dioxide method. The difference in the percentages of U. S. Extras (top grade) going into and coming out of storage was 2.07 for eggs subjected to the vacuum-carbon dioxide oiling treatment, 26.82 for the eggs machine-dipped in carbonated oil, 33.27 for eggs machine-dipped in plain oil, and 66.52 for untreated eggs. In the same order, the differences in the percentages of U. S. Extras and U. S. Specials (taken together) going into and coming out of storage were 16.99, 43.68, 46.69, and 68.02, respectively. These results show conclusively the superiority of the Bureau's vacuum-carbon dioxide

oiling treatment for retarding the enzymic deterioration of eggs during cold storage.

ENZYME ACTION AT LOW TEMPERATURE

In continuation of research on enzyme action at low temperatures, a project conducted under the Bankhead-Jones Act of June 29, 1935, providing for basic research in agriculture, it was found that enzyme action in the frozen state may be detected without thawing out the material. This discovery may result in marked improvement of methods for food research at low temperatures. A proteinase that is active at low temperatures was isolated from beef muscle. This was identified as a cathepsin, which would not necessarily be influenced by the oxidation-reduction equilibria of the tissues. Its role in the decomposition of stored meat, while fairly obvious, remains to be demonstrated. Studies on milk clotting proved that an enzyme may produce different reactions at low and high temperatures.

Lipase, the fat-splitting enzyme, was found to be particularly active in the frozen state, but only on certain fats. The composition of the fat, which varies with the diet, would therefore seem to influence the keeping quality of frozen meat. Pancreas lipase appeared to digest only the esters of primary alcohols. This behavior is very different from that generally depicted in the literature. A new and more sensitive method of demonstrating lipase action was found, which greatly facilitated the investigation. This method was used to isolate esterase from beef muscle. This ferment, which is active at low temperatures and seems to be responsible for some of the changes in the fats of stored meat, is receiving further attention because of its apparent importance.

INDUSTRIAL FARM PRODUCTS RESEARCH

HIDES AND SKINS

In studies on the spoilage of salted calfskins completed during the year, a correlation was shown between moisture content, bacterial population, and chemical decomposition. These studies emphasized the critical dependence of spoilage upon the amount of moisture present. Reduction of salt content from 14 to 12 percent, accompanied by increase of moisture from 49 to 56 percent, increased the bacterial population more than 35 times in calfskins stored for 30 days at 30° C. This increase in bacteria and the ensuing microbial spoilage of the skin resulted in the formation of nearly 19 times as much ammonia nitrogen and over 3 times as many free carboxyl groups. These data explain in large measure the excessive spoilage sometimes experienced in commercial practice when hides and skins take up appreciable quantities of water, due to extremely humid weather, condensation of atmospheric moisture, inundation, or other causes, and suddenly decompose to the extent of almost complete ruin.

In continued efforts to improve the curing of hides and skins by adding small quantities of antiseptic chemicals to common salt, experiments were made with orthodichlorobenzene, which was found to be ineffective, and with zinc oxide, which increased preservation to a marked degree when added to the extent of 1.3 percent. The zinc oxide-salt mixture, however, was definitely less effective than salt containing 0.5 percent of sodium silicofluoride and 0.1 percent of paranitrophenol, a mixture used in previous experiments. Salt containing sodium pentachlorphenate was found to be inferior to the mixture of salt and sodium trichlorphenate previously used.

In semicommercial experiments to determine the effects of extended cold storage on the leather-making value of salted calfskins, opposite sides of the same skins, which had been in storage for different periods, were compared. Both lots were tanned similarly into chrome shoe-upper leather by a commercial tanner, one after being in cold storage for 14 months and the other for 26. The two lots of leather were of about the same grades and selections and, according to a disinterested leather sorter, there was little, if any, significant difference between them. Quantitative testing and rating of these leathers, however, have not been completed.

The Bureau entered into a formal cooperative agreement with the Bureau of Biological Survey, providing for fundamental research on the influence of the life history of fur-bearing animals on the physical, chemical, and histological properties and hence the value of fur skins. These studies will be coordinated with the work of the Bureau of Biological Survey on raising fur-bearing animals.

TANNING MATERIALS

Canaigre was definitely decided upon as a plant worthy of reconsideration and study in the collaborative program of research with the Bureau of Plant Industry on the development of new domestic tanning materials, preferably in the form of new field crops. The root of this plant is rich in tannin, and it is hoped that through research valuable products in addition to tannin extract may be developed from the roots to help pay the cost of producing and processing the crop.

Plantings of canaigre were made at the New Mexico Agricultural Experiment Station to obtain data on yield and other cultural aspects, to start progeny plots for selective propagation of strains especially high in tannin, and to obtain a sufficient quantity of roots for laboratory studies. Selected roots were also planted at 12 points in Texas to obtain information as to localities in that State best adapted to the growing of canaigre.

Analyses were completed on about 100 samples of the stock used in the planting program. Laboratory studies are in progress to determine the optimum conditions for processing canaigre roots to obtain tanning extract and other products.

Many facts concerning the growing of canaigre, locations best suited to this crop, cost of production, yield of roots, merits of the tanning extract that might be made from them, and markets for the extract must be learned before any sound decision can be made as to the economic possibilities of this plant. Initiation of large-scale farming with canaigre should be deferred until such information becomes available. This will require several years.

LEATHER

Studies to obtain information on the minimum quantity of chrome for durable combination vegetable-chrome leathers were completed. It was found that resistance to rotting upon exposure to acid fumes is not directly proportional to the chromic oxide content but increases until about 1.5 percent of chromic oxide is present, after which it remains essentially the same up to about 3 percent. After 18 weeks of accelerated aging, leathers containing from 1.6 to 2.8 percent of chromic oxide lost from 43 to 48 percent of their original strength, whereas the controls, which contained no chromic oxide, lost 70 percent or more. A chromic oxide content of 1.5 percent was tentatively fixed as the minimum for the combination vegetable-chrome retanned type of leather. This degree of retannage may be secured readily while still maintaining predominantly the characteristics of a vegetable-tanned leather. Every retanned leather containing 1.5 percent or more of chromic oxide will not necessarily have increased resistance to acid rot. Additional evidence was acquired that in commercial practice the tannage may be supplemented by materials and processes that have deleterious effects sufficient to offset the added resistance imparted by chrome.

Acting upon the findings and advice of this Bureau, the Government Printing Office is now using only leathers of a chrome or combination vegetable-chrome tannage for binding. These leathers have displaced the straight vegetable-tanned leathers used heretofore.

The production from cattle hides of a combination vegetable-chrome leather, known as airplane weight, for upholstering airplanes is a comparatively recent development in the leather industry. A sample of such leather was obtained and tested with the thought that similar leather might be produced commercially in suitable weight for bookbinding. It had an initial pH value of 3.8 and a chromic oxide content of 2.2 percent. It showed moderate resistance to acid rot in the accelerated tests, losing 28 percent of its original strength after 12 weeks of exposure and 50 percent after 18 weeks.

Through committee memberships the Bureau cooperated with the American Leather Chemists Association, the Federal Specifications Executive Committee, and the committee on shoes of the American Standards Association.

UTILIZATION OF FARM WASTES

Experiments were made on the production of moldable plastic from sugarcane bagasse by partly decomposing the cellulose into sugars and the pentosans into furfural by acid hydrolysis under pressure and allowing the residual lignin to react with the furfural and added aniline to form resins. The Forest Products Laboratory, which had prepared such plastics from the lignin in wood, cooperated in this work. Moldable plastic in powdered form was produced that

was equal, if not superior, to that prepared from wood. Preliminary experiments in which the resinified lignin was dissolved in alkali and then precipitated with acid indicated that a superior plastic might be produced in this manner. The thermoplastic flow of the molding powder produced from bagasse was much lower than that of the best commercial products but approached that of some of the molding powders in use. Suggestions regarding equipment required and procedures for making moldable plastic from bagasse were given to a sugar-producing firm which is planning to erect an experimental laboratory and pilot plant for the further study of this problem.

Preliminary investigations on the use of alcoholic nitric acid as a pulping agent for sugarcane bagasse were completed. Good yields of pulp with relatively high α-cellulose content were obtained. A study of its characteristics indicated that this pulp, which is high in pentosans but low in lignin, might be especially useful in papermaking as a substitute for the short-fibered pulps from deciduous woods in book and magazine papers.

Continued studies on the pulping of bagasse by the nitric acid process, in which a percolator type of liquor circulation was used, indicated that a lower ratio of total acid liquor to bagasse may be used advantageously by this means.

Experiments were continued, in cooperation with a commercial firm, on the production of improved paper pulp from straw. In view of the marked interest shown by industrial technologists in the possibility of applying to straw the sulphate process, now used for the production of kraft wrapping papers from coniferous woods, special equipment was obtained to continue the study of straw pulping by the kraft process for the specific needs of the boxboard and kraft-paper industries.

Results obtained in the study on direct causticizing of black liquors from the soda pulping process, to permit reuse, were correlated and published, thus completing this investigation. It was found that weak soda black liquors used in pulping fibrous farm wastes can be fortified by direct causticization for reuse about 10 times. After 10 cooks the organic matter has increased to such an extent that the usual soda-recovery method by ignition may be used.

The conductometric method for determining the degree of "spentness" of pulping liquors, mentioned in last year's report, was used in connection with the recausticizing of soda liquors and also for the examination of liquors from the nitric acid and sulphate pulping processes. By this method the quantities of nitric, oxalic, formic, and acetic acids, as well as some complex organic acids and amine and ammonia compounds, in used nitric acid pulping liquor may be determined rapidly and fairly accurately. The method also provides a means for rapid and fairly accurate determination of the hydroxide, carbonate, sulphide, sulphite, acetate, sulphate, and thiosulphate radicals in admixture in used sulphate pulping liquor. Experimental work with this method as applied to the examination of kraft (sulphate) pulping liquors is nearly completed. Results obtained in its use for control of direct causticizing of soda black liquors and examination of nitric acid pulping liquors were published.

In a study of the effects of temperature on the yields of products from the destructive distillation of corncobs, it was found that the maximum yields of useful products were obtained at about 700° F. The heating value of the non-condensable gases from corncobs was greater at the higher distillation temperatures.

LIGNIN

In order to determine the extent to which certain carbohydrates yield insoluble products when subjected to the action of strong mineral acids, such as those used for the isolation of lignin, and the degree of error in quantitative estimations of lignin resulting therefrom, experiments were made with fuming and dilute hydrochloric acid on arabinose, xylose, glucose, mannose, galactose, fructose, sucrose, maltose, starch, inulin, pectin, and cellulose. The only carbohydrates found to yield insoluble residues were fructose (1.8 percent), sucrose (0.9 percent), and inulin (1.8 percent). The same carbohydrates were the only ones that caused apparent increases in the results for lignin when definite weights of extracted wheat straw of known lignin content were added to individual carbohydrates before the acid treatments, and the apparent increases in lignin content of the straw were exactly equivalent to the insoluble residues obtained from the carbohydrates alone. It is reasonably certain that when a quantitative estimation of lignin in plant material is made by the method developed in this Bureau, no error will be introduced by the presence of carbohydrates likely to be associated with the lignin, because the method provides for preliminary

extractions, with 1:2 alcohol-benzene mixture, hot water, and boiling 1-percent hydrochloric acid solution in succession, which remove such interfering substances.

It was found that when lignin, isolated from straw by means of fuming hydrochloric acid, was treated alternately with cold fuming hydrochloric acid and boiling 5-percent hydrochloric acid there was a loss in weight. When the alternate treatments were repeated four times, using in each case some of the residual lignin from the preceding experiment, there was a loss in weight each time, although such loss was less than in the first experiment. After each experiment the percentage of methoxyl in the residual lignin remained practically the same as in the original lignin, indicating that the loss in weight was due not merely to removal of impurity but rather to a degradation of the lignin complex. From these results it was concluded that, contrary to the generally accepted belief, lignin is not entirely resistant to hydrolysis by mineral acids. The possibility of using acid hydrolysis in determining the chemical structure of lignin is being investigated.

Lignin from wheat straw was separated into three fractions. The first and second fractions were isolated by successive and exhaustive extractions, first with a 2-percent alcoholic sodium hydroxide solution at room temperature and then by refluxing with a 4-percent aqueous sodium hydroxide solution. The third fraction was isolated with fuming hydrochloric acid from the straw remaining after the first and second extractions. From analytical data and a study of derivatives it was concluded that the first fraction had the empirical formula $C_{42}H_{48}O_{16}$ or the dissected formula $C_{38}H_{31}O_7(OCH_3)_4(OH)_5$. Of the five hydroxyl groups, three could be methylated with diazomethane, indicating that these three hydroxyl groups are probably more acidic than the others, being possibly phenolic or enolic. This lignin fraction, when fused with potassium hydroxide, yielded 4.5 percent of protocatechuic acid, based on the weight of lignin. The second lignin fraction was found by analysis to have the empirical formula $C_{40}H_{42}O_{16}$. Approximately four methoxyl and four hydroxyl groups were found to be present. The third lignin fraction contained substantially the same percentage of methoxyl as the first. The percentage of carbon in this fraction was greater than that in either of the other two fractions.

It was found that when lignin-containing materials, such as wood or various crop wastes, are heated under pressure with alcohols in the presence of a catalyst, such as hydrochloric acid, the glucoside linkage between lignin and the carbohydrates is broken and the liberated lignin possesses desirable adhesive properties. By means of this process, for which a public-service patent was requested, it is possible to prepare fibrous molded products from crop wastes, such as straw, stalks, leaves, hulls, and cobs, and from other lignin-containing materials without the use of synthetic resin or any other added binder.

HEMICELLULOSES AND LIGNOCELLULOSES

A fundamental investigation on the chemistry and structure of the hemicelluloses and lignocelluloses in cereal straws, hays, and other forage crops was started as a project under the Bankhead-Jones Act of June 29, 1935. Comparatively little is known about the hemicelluloses and lignocelluloses. In addition to the scientific interest in these substances, fuller knowledge concerning their chemical properties, structures, and possible derivatives may lead to the development of new uses for them.

Because of delays incident to the procurement of equipment and additional personnel, laboratory work has been in progress for only about 6 months. This time was given to the investigation of various procedures for separating the hemicelluloses of alfalfa hay and wheat straw from fatty and waxy materials, pectin, lignin, and cellulose. Much difficulty was encountered in completely delignifying the hemicelluloses without decomposing them to some extent. A satisfactory procedure was finally developed for isolating the crude hemicelluloses from straw and separating them into three fractions for subsequent investigation.

FERMENTATION INVESTIGATIONS

In studies on the decomposition and disintegration of cellulosic crop wastes by anaerobic fermentation, it was found that the cellulose and pentosans in cornstalks are readily attacked by bacteria, with the formation of combustible gases, at the temperature ranges of 28° to 30° and 50° to 55° C. The decomposition of cellulose was greater at 28° to 30°; that of pentosans, at 50° to 55°.

Lignin was decomposed to some extent in both temperature ranges. The optimum methane production occurred at pH 7.0 to 7.4 at both temperature ranges. The effect of temperature on the rate of gas production was influenced more by the size of particles attacked than by variation in the chemical composition. Glass and stainless-steel containers were satisfactory for the fermentation, but copper and galvanized iron were found to be toxic. Sheet-iron containers gave erratic results, with indications that there might be some toxicity involved.

Some of the cultures isolated and purified in the study of anaerobic processes that might be useful for retting flax and other bast fibers were found to be facultative species. Fat-splitting, proteolytic, and gelatin-liquefying micro-organisms were more prevalent in the earlier than in the late stages of fermentation.

An improved combustion pipette having structural and operative advantages was designed for use in gas analysis incidental to the fermentation investigations. It proved to be satisfactory for routine determinations of methane.

Mold fermentation studies on the production of dextrolactic acid from glucose by submerged growths of *Rhizopus oryzae* in aluminum rotary fermenters resulted in definite improvements in time of fermentation, yield, and purity of product. The fermentation of 12- to 13-percent glucose solution now requires from 30 to 35 hours with 75- to 80-percent conversion to dextrolactic acid. Small quantities of the rare dextrolactic acid and its salts were supplied to scientific workers, most of whom were engaged in medical research.

A series of fermentations of glucose with *Aspergillus niger* in the large rotating aluminum fermenter was completed, resulting in the production of about 3 tons of calcium gluconate. A 200-pound charge of commercial corn sugar in 140 gallons of water was converted to gluconic acid within 24 hours, using 200 liters of air per minute at 30 pounds gage pressure, the yield being 97 percent of theoretical. The fungus growth remaining at the end of a run was found to be still active and capable of converting glucose to gluconic acid. The transfer of a portion of this active growth to a new charge made possible a semicontinuous process by eliminating the pregermination stage and other steps. This semicontinuous method eliminates the lag of 6 to 8 hours usually necessary for sufficient mycelial growth and allows the fermentation to be completed in from 15 to 17 hours.

Representatives of commercial firms visited the Agricultural Byproducts Laboratory at Ames, Iowa, to acquaint themselves with the production of gluconic acid from corn sugar with the purpose of adopting this process. Another firm is contemplating the adaptation of the rotating-drum fermentation process to the production of acetyl-methyl carbinol (butter flavor).

Certain bacteria of the *Acetobacter* group are known to oxidize glucose to gluconic acid, and efforts are being made to use them in a practical fermentation process in which the formation of calcium gluconate, essential to the submerged mold process, would be eliminated. Preliminary studies indicated that high yields of free acid are possible since the presence of a high concentration of the acid (pH 2.1) does not interfere with continued fermentation, as it does in mold fermentation.

Studies on the production of levosorbose from dextrosorbitol by fermentation with submerged growths of *Acetobacter suboxydans* were completed. The small-scale laboratory experiments were adapted successfully to an industrial scale, resulting in the development of a highly efficient method for the manufacture of this hitherto rare ketose sugar. Levosorbose is of commercial importance because it is the starting material for the manufacture of levoascorbic acid, synthetic vitamin C. In both the laboratory and large-scale experiments, under the most favorable conditions, yields of levosorbose in excess of 90 percent of theoretical were obtained by fermenting 20-percent sorbitol solutions for 24 hours. About 70 percent of the sorbose produced in large-scale experiments was recovered in a high degree of purity by crystallization. The residual sugar is difficult to recover. Samples of the crystallized sorbose and the sorbose-containing molasses were sent to scientists for use in research.

MOTOR FUELS

The use of ethyl alcohol in combination with gasoline as a fuel for modern motor cars is technically possible, blends containing from 10 to 20 percent of alcohol probably giving better over-all efficiency than those containing lower percentages of alcohol. In view of this fact, there is widespread belief that the use of alcohol produced from cereal and root crops as a constituent of

motor fuels is highly desirable, since such production would benefit agriculture and help to conserve petroleum resources.

From information gained in the Bureau's general survey of the factors involved in the production of alcohol for motor fuel, it appears that the surplus and otherwise unmarketable portions of farm crops produced annually in the United States might yield alcohol equivalent to at least 2 percent, and possibly as much as 6 percent in an exceptional year, of the country's present gasoline requirements. The quantity and the production cost of alcohol obtainable from such sources would, however, fluctuate widely from year to year. Much surplus and cull material is low in alcohol yield or widely distributed and therefore unusable from an economic standpoint. Production of limited quantities of alcohol for use in motor fuels from agricultural materials might be possible in local areas without serious disturbance of crop prices, but the intermittent use of blended motor fuels containing varying concentrations of alcohol would probably result in operating difficulties. The present costs of producing anhydrous industrial alcohol do not permit direct competition of gasoline-alcohol blends with straight gasoline, but advances in the price of gasoline or reductions in the cost of producing alcohol in future years might favor the use of alcohol obtained from agricultural sources.

Certain difficulties stand in the way of the Nation-wide use of a blended motor fuel containing only 10 percent of alcohol. Sufficient agricultural raw materials to produce the alcohol required for such a blend could not be obtained at present production levels without affecting normal prices and markets. The additional alcohol-processing plants required probably could not be brought into existence in less than 5 years, and the capital investment for these plants would be very large. The use of motor fuel containing alcohol would increase Government costs in preventing tax evasion by illegal diversion of alcohol, since no denaturant is known that would be wholly effective in preventing such diversion. It is certain that the production of motor-fuel alcohol in small farm plants under individual ownership would not be economic.

A bulletin reporting the Bureau's survey of the possibilities of producing alcohol for motor fuel is now in press.

CHEMICAL CONVERSION OF OILS, FATS, AND WAXES

Special attention was given to the chemical conversion of oleic acid, one of the fatty acids present in lard and edible vegetable oils. Several readily available aromatic compounds were combined with oleic acid to form aryl-stearic acids and their esters. Some of the products so obtained have potential value as intermediates for the preparation of textile and leather-finishing assistants, soaps, cosmetics, synthetic waxes, polishes, coating compositions, fungicides, and addition agents for lubricants. The last-mentioned use alone would create a demand for about 15 million pounds of fatty oils annually if only 10 percent of the lubricating oil consumed in the United States were treated with 2 percent of these fatty acid derivatives.

The reaction of red lead in acetic acid upon the hydroxylated fatty acids and their derivatives was also studied. It results in the cleavage of the chains between adjacent hydroxyl groups, yielding two or more aldehydic products of lower molecular weight. By this means a great variety of aldehydes can be produced from fatty material, and these may be used directly or converted to other products. Pelargonic aldehyde, which was obtained in good yield from oleic acid, is used in fine perfumes. The half aldehyde of azelaic acid remaining in the residue after treatment of oleic acid with red lead may be converted to azelaic acid, from which a wide variety of esters having possible use as plasticizers can be synthesized. The aldehyde group lends itself well to further chemical reaction, since aldehydes can be oxidized to acids, reduced to alcohols, polymerized, or employed in substitution reactions.

PLASTICS

The Bureau began research on the preparation of plastics from materials derived directly or indirectly from agricultural products. Attention was first given to dextrolactic acid, a product obtained from corn sugar in the mold-fermentation investigations. This product was used for the synthesis of methyl acrylate, from which "organic glasses" are derived by polymerization by a process involving four steps. Attempts will be made to reduce the number of steps and thus provide a more economical procedure.

A new type of alkyd resin was prepared by first making glyceryl dilactate from lactic acid and glycerol and then esterifying the free hydroxyl groups with phthalic anhydride or other dibasic acids. The products were faintly yellow, tough, and resilient, and appear to be an improvement over the glyptal resins used commercially in the manufacture of lacquers. In a similar manner resins can be made from other hydroxy-carboxylic acids, such as saccharic, citric, and tartaric acids. The phthalic anhydride can be replaced by sebacic, azelaic, and other dibasic acids of agricultural origin.

SOYBEAN PRODUCTS

Research on soybeans and soybean products, designed to promote their industrial utilization, was carried on actively by the Bureau's Regional Soybean Industrial Products Laboratory at Urbana, Ill., in cooperation with the Bureau of Plant Industry and the agricultural experiment stations of the North Central States. This work is part of the Department's program of basic research in agriculture, provided for by the Bankhead-Jones Act of June 29, 1935.

Organization of the laboratory was completed, and material progress was made in some phases of the research program. Results were reported in eight papers published in various scientific and trade journals.

As an aid to the agronomic investigations, analyses were made of about 500 samples of soybeans, using standard methods and improvements developed by the laboratory. A large number of analyses and special determinations were also made in connection with the chemical and technological investigations.

The mechanical equipment for the preparation of soybean products was tested out by experimental runs to establish standard operating conditions.

Three samples of oil extracted from the same variety of soybeans but having very different iodine numbers were examined to determine what factors were responsible for this variation. They showed no significant differences in percentages of unsaponifiable matter or in total, saturated, and unsaturated fatty acids. However, calculation of the composition of the unsaturated acid fractions indicated that the oil of lowest iodine number contained nearly twice as much oleic acid and about half as much linoleic acid as the other two oils. Contrary to expectations, the low iodine number and relatively lower content of polyethenoid acids were not reflected in markedly greater stability of the refined or the hardened oil over that of normal oil.

To aid in studies of the composition of soybean oil, three molecular or short-path high-vacuum stills, representing both the pot and column types of construction, were set up and put into operation. The smaller pot still functioned satisfactorily for the distillation of the saturated triglycerides contained in hydrogenated soybean oil. Coloring matter and other impurities were concentrated in the fractions obtained at lower temperature ranges (up to 240° C.); fractions obtained at higher temperatures (240° to 260°) appeared to have a high degree of purity. In the column still, numerous distillations were carried out with crude and alkali-refined soybean oil. Appreciable fractionation occurred. It is expected that this apparatus will prove useful in isolating the minor constituents of soybean oil, particularly those that influence stability of flavor and odor.

Several new pieces of laboratory apparatus for refining and deodorizing soybean oil and determining color, stability, and "break" were installed and are being used to evaluate the expeller oil produced experimentally.

In a study of the usual methods for measuring the apparent conjugated double bonds in soybean and other vegetable oils, it was found that the presence of hydroxyl and peroxide groups causes erroneous results.

As part of the investigation of the film formation and durability of soybean oil used in coatings, 72 varnishes, 3 aluminum paints, 68 white paints, and 15 colored enamels were prepared and are being exposed to the weather on test panels. Considerable progress is being made in the development and perfection of varnishes containing soybean oil alone as the oil constituent. These varnishes are standing up well under test and have attracted the attention of varnish manufacturers. It was found that the drying properties of soybean oil used without metallic driers are improved somewhat by acetylation, but much experimental work remains to be done before the economic and practical value of acetylation and other chemical treatments for improving the drying properties of soybean oil can be ascertained.

Efforts were made to detect and isolate the product or products responsible for the production of rancidity, flavor reversion, and development of odor in

refined soybean oil, but thus far no conclusive evidence has been established concerning the products or mechanism involved in oil reversion.

The sterol glucoside previously found in expeller oil was purified and the sugar portion identified as dextrose. Stigmasterol, an important starting material for the synthesis of female sex hormones, was isolated from the sterol mixture obtained from expeller oil. It was found to constitute a substantial fraction of the sterols of the soybean.

It was discovered that the tendency of expeller oil to "break" on heating can be removed by stirring the oil with 4 percent by weight of adsorbent for 2 hours at 75° to 80° C. and filtering. It was also found that the use of adsorbent columns offers a method of separating the nitrogen and phosphorus compounds of the oil from each other.

In order to obtain information that will be useful for the production of purified protein fractions from oil-free soybean meal, studies were made on the effects of acids, alkalies, and salts on the dispersibility of soybean proteins in water. From 85 to 90 percent of the nitrogen compounds in defatted soybean meal can be dispersed by distilled water at room temperature. Dispersion is retarded by acids and is practically inhibited at a pH value of 4.1. Addition of dilute salt solutions reduces the inhibiting effect of acid, but neutral salts alone have a distinct inhibiting effect that is greater for salts of divalent metals than for those of monovalent metals. Alkalies increase the dispersion of soybean proteins in water. Evidence was found of the presence in soybeans of a protein-dispersing agent other than salts, probably lecithin, which is responsible for the completeness with which soybean protein is dispersed by water alone. It was noted that the amount of protein material that can be extracted from oil-free soybean meal with water or salt solutions decreases with the aging of the meal.

A study on the dispersion of protein from fat-free soybean meal in the presence of a hardening or tanning agent resulted in the discovery that the protein can be dispersed in a formaldehyde solution. Formaldehyde reduces the amount of protein dispersed, but dispersion of 60 percent or more of the crude protein seems to be possible at a pH of about 7.0. Extraction of protein from oil-free soybean meal by means of formaldehyde solution yields hardened protein that has possibilities of industrial utilization for plastics, adhesives, and other products.

It was discovered that soybean protein that had been treated with formaldehyde solution, and then dried and pulverized, possessed thermoplastic properties and could be shaped in hot molds, provided the moisture content was at least 5 percent. A commercial soybean-protein fraction treated in this way yielded fairly satisfactory molded products. Experiments are in progress on the preparation of improved molding powders by combining formaldehyde-hardened soybean protein with materials that will improve the plastic flow and increase water resistance, or with other thermoplastic products. Results thus far indicate that it may be possible to develop from soybean protein a high-grade plastic that will come from the mold in a finished state. This would be a great advance in protein plastics. Casein, the only protein plastic of commercial importance at present, requires a very long hardening process after being molded or formed to shape.

In a study of the effect of moisture content on the plastic properties of soybean protein and oil-free meal, it was found that these materials possess some plasticity independent of free water content. In this respect they resemble zein, the protein of corn, and differ from milk casein.

CHEMICAL WEED KILLERS

In further studies on the production of sodium chlorate, the efficiency of two types of electrochemical cells of improved design was determined on a semi-plant scale. The consumption of electric current by these cells corresponded to 3 kilowatt-hours of alternating current per pound of chlorate as crystals. This represents a reduction of 10 percent in this item of cost.

It was found possible to produce sodium chlorate of high purity by displacing it from solution with sodium chloride. Laboratory experiments indicated that this is a more economical method of separating sodium chlorate from electrolytic cell liquors than the evaporation procedure previously employed.

Studies are in progress, in collaboration with the Bureau of Plant Industry, on the herbicidal value of inorganic oxidizing compounds, nitric acid admixed with dehydrating mineral acids, certain coal-tar fractions, and water-soluble polynitro organic compounds.

BIOLOGICAL STAINS

About 30 biological stain samples were identified and analyzed for the Commission on Standardization of Biological Stains as part of its certification procedure.

In compliance with a request from the publishers, the dye monographs for the forthcoming new edition of the National Formulary were revised to conform to the recommendations of the Commission on Standardization of Biological Stains for certified stains and staining solutions.

Aid in the solution of problems relating to the use of biological stains for various purposes was given to the representatives of several Government agencies and to other individuals and agencies.

NAVAL STORES RESEARCH

CHEMISTRY AND TECHNOLOGY OF NAVAL STORES (TURPENTINE AND ROSIN)

Progress was made in the difficult separation of the liquid and solid portions of pine gum and in the fractional crystallization of the latter. Simple gravity filtration through cloth was used as a preliminary step. Not only is the gum filtrate so obtained practically free from crystallizable resin acids, but the residue is in good condition for recrystallization. A basket-type centrifuge was used for filtering the liquid from some of the crystal fractions.

In the investigations on rosin it was found that a special rosin, substantially free from the tendency to crystallize, can be prepared from the filtrate obtained by direct gravity filtration of settled pine gum. This product differs from ordinary rosin in being high in neutral products (resenes, etc.) and low in pimaric acids. It should prove useful for the manufacture of gloss oils, core oils, adhesives, soaps, and other products for which ordinary rosin is unsuitable. An application was filed for a public-service patent on this product.

Preliminary examinations were made to determine the absorption spectra of a number of the resin acids from pine gum and their hydrogenated products. This study may throw light on the purity, character of unsaturation, and other questions regarding the structure of these gum constituents.

It was found that so-called α-pyroabietic acid, for the preparation of which from rosin and rosin acids an improved catalytic method was devised by the Bureau in 1937, is not isomeric with abietic acid but is a complex mixture of dehydroabietic, dihydroabietic, and tetrahydroabietic acids, resulting from a reaction which is essentially dehydrogenation and hydrogenation but not isomerization, as was formerly thought. Experiments were made on the direct use of pine oleoresin, without previous conversion to rosin, for the preparation of the so-called pyroabietic acid and a stabilized rosin, using the catalytic method developed for rosin.

An investigation is in progress to determine the nonpinene constituents of gum spirits of turpentine that are separated in distillation as the first or most volatile fraction (heads or forerun) and the high-boiling residue (tailings). Preliminary findings indicated that the tailings are relatively high in hydroxyl compounds, methyl ethers, such as anethol, and monocyclic terpenes, such as dipentene.

Dehydration of turpentine is a growing practice among naval stores producers as a means for retarding the discoloration of turpentine when stored in iron containers. A simple test was devised for determining the effectiveness of any dehydration process. This consists in placing the processed turpentine in a number of test tubes, each bearing a thermometer, placing the tubes in a series of cold baths of different temperatures, and noting the highest temperature at which turbidity occurs, together with the degree of turbidity.

A method of detecting and measuring the tendency of rosins to crystallize was developed in cooperation with representatives of two commercial firms. This method requires that the rosin be subjected to a temperature of 100° C. for a long time. A much accelerated test is now in course of development by the Bureau.

In experiments on the use of the mixed copper salts of rosin acids for rotproofing small paper pots for growing plant seedlings, it was unexpectedly found that the copper-rosin compound stimulated plant growth. The pots treated with the copper-rosin compound gave better results in growing tomato seedlings than were obtained with several kinds of commercial treated and untreated pots of similar type. In preliminary vegetative experiments, in which the copper-rosin compound was added to greenhouse soil in two concentrations and com-

pared with the same soil containing equivalent quantities of copper in the form of sulphate and with untreated soil, marked stimulation of growth of tomato and corn plants was observed in the soil containing the copper-rosin compound but not in the others. Apparently the metallic component is not entirely responsible, since powdered rosin in the one experiment carried out with this material also showed a stimulating effect. Arrangements have been made with the Bureau of Plant Industry for cooperative research on this project.

The most extensive chemical use for rosin is saponification. Rosin is saponified alone for paper size and in combination with fatty acids for laundry soaps. It is not used extensively in the manufacture of toilet soaps, principally because it imparts certain objectionable properties to the product. With the hope of improving the quality of soaps, and possibly of paper size, that can be made from rosin, investigations were made on the extent and cause of color development in the saponification process. A laboratory method was devised for preparing rosin soap cakes containing 20 percent of rosin and also for evaluating their color. It was designed to give results similar to those obtained industrially by the full-boiled soap process rather than those obtained by the semiboiled and cold processes, since the first is more extensively used in the manufacture of rosin soaps. Photoelectric measurements of green light reflected by the specially prepared soap cakes in comparison with that reflected from a freshly deposited coating of magnesium oxide were found to provide a rapid and convenient means for evaluating the color. Experiments on the production of soaps from rosins of known history indicated that the source of the gum (whether longleaf or slash pine), cleanliness of the gum, the time of year when the gum was collected, and contamination with zinc, aluminum, and moderate quantities of iron, did not have any material influence on the color of the soap. However, rosins made from gum containing 20 percent or more of scrape gave more color to soap than did rosins made from gum free from, or low in, scrape.

Experiments on making soap with primary resin acids from pine gum, with rosin acids, and with resenes, and with the same materials after extended heating or exposure to the air in powdered form, indicated that acids of the abietic type give soaps of pronounced color, whereas pimaric acids and pyroabietic acid give stable white soaps. Soaps made from oxidized rosin and resin acids had the same hue as those made from rosin containing 20 percent or more of scrape but were darker. Resenes had little or no influence on color. It was concluded that the color imparted to soaps by a pale rosin is due primarily to the presence of abietic-type acids formed by heat isomerization of the primary resin acids, whereas the color imparted by rosins of lower grade is due chiefly to the oxidized rosin acids.

Experiments with rosins made from gum contaminated with iron and treated in two ways with oxalic acid to lighten the color of the rosin indicated that the presence of oxalic acid in the gum during distillation promotes isomerization to abietic-type acids and thus causes the rosin, although paler, to make dark-colored soaps. This detrimental effect can be prevented by adding the oxalic acid in solution and removing it before distillation.

Experiments on the use of turpentine, turpentine fractions, rosin, and salts of resin and rosin acids in motor fuel, to reduce engine knocking, did not yield promising results. Such experiments are being continued with other naval stores derivatives.

PRODUCTION AND PROCESSING OF NAVAL STORES

Research work on processing pine gum was continued at the Naval Stores Station at Olustee, Fla., for the purpose of developing and improving processes, equipment, and technique for new and improved products, and preventing deterioration and losses in the handling and processing of gum and its products. Turpentine and rosin from gum of known history were produced for the Bureau's research on chemistry of naval stores. The naval stores station also served as an educational center for producers and others interested in the production of naval stores. Personal instructions, often illustrated by demonstrations, were given to most of the 706 persons who visited the station during the year.

About 1,300 barrels of gum were distilled on a commercial scale with the fire still. Experiments to determine the temperature of the flue gases at various points in the fire path of a fire still showed that the temperature is influenced by the method of firing and location of fuel in the firebox. This information

led to an improved firing technique. The experiments also furnished data for determining the correct size and location of flues necessary for distributing the flue gases from the firebox to the fire path so as to provide an even distribution of heat and thus prevent overheating at some points. The data obtained in the operation of the fire still were made available to producers.

A bulletin giving plans, specifications, and bills of materials for different types of fire still buildings and equipment, and detailed instructions for setting a fire still, was prepared for publication.

An increasing number of farmers are producing turpentine gum for sale. Because of the rapid increase in buying gum and the accompanying tendency toward the development of central distillation plants of large capacity, the Bureau's research on methods for cleaning gum and on the steam still, which is especially adapted to cleaned gum, is assuming increasing importance. Work at the naval stores station along these lines will be of direct assistance to the industry, since the results can be applied without further pilot-plant experiments. During the year about 1,210 barrels of gum were run through the experimental gum-cleaning equipment, and about 770 barrels of cleaned gum were distilled with the steam still.

Experiments on cleaning gum showed that, with the type of equipment available, best results can be obtained by starting the filtration at the relatively low pressure of 15 pounds and gradually increasing the pressure to maintain a constant flow of gum through the filters. This avoids "plugging" the filters and the resulting necessity of frequently changing the filtering medium. By heating the gum to about 225° F. and filtering through paper in filters of a new type designed by the Bureau, an average filtration rate of 25 gallons per minute per square foot of filter area was obtained. Experience with the experimental gum-cleaning equipment at the naval stores station will lead to simpler and less costly equipment for use in the industry.

The steam still continues to show an advantage over the fire still. Because of better heat control, the steam still makes more uniform products. Moreover, it is faster and easier to operate, it practically eliminates the fire hazard, and it has a greater production capacity. The steam still was used to secure engineering data on heat requirements for distilling cleaned turpentine gum. The results indicated that diluted clean gum containing about 40 percent of turpentine, 5 percent of water, and 55 percent of rosin requires about 0.77 pound of steam at 185 pounds gage pressure per pound of gum. This means that approximately 2½ boiler-horsepower-hours are required to distill 100 pounds of cleaned, diluted gum with steam at 185 pounds gage pressure and boiler feed water at 70° F.

New experimental gum cups of various materials and designs were hung on new crops of slash pine to check the results of previous tests with similar cups on longleaf pine to determine relative durability, ease of cleaning, evaporation loss, and tendency to stain the gum. In the first series of experiments, completed last year, it appeared that all the metal cups caused some discoloration of gum. Lead-coated and galvanized iron had the most effect on color, and zinc and aluminum had the least. Gum collected in glass, clay, aluminum, and zinc cups made the highest grades of rosin.

The removal of suspended and dissolved water from turpentine at the time of production is necessary because turpentine containing water discolors rapidly when stored in most metal containers. The water that settles out of turpentine also weakens the glue lining of wooden turpentine barrels, causing leakage. All the turpentine produced at the naval stores station is conditioned by passing it through a dehydrator of simple design containing coarsely granulated rock salt as the dehydrating material. Experiments indicated that this type of dehydrator removes most of the suspended water but does not remove dissolved water, which may separate later. A small refrigerating unit was installed for cooling the turpentine between the separator and dehydrator in order to separate the dissolved water. A larger refrigerating unit than was available would be necessary to give additional benefit.

COOPERATION WITH STATES IN NAVAL STORES WORK

Information concerning improved practices and equipment developed at the naval stores station was carried to naval stores producers in Florida and Georgia by cooperative agents who made personal contacts with producers individually or in groups. These agents also disseminated information concerning approved, conservative woods practices developed by the Federal and State forest services for the production of naval stores.

In Florida, 232 visits were made to naval stores operators, factors, county agents, foresters, and timber owners in connection with problems relating to naval stores production. Twenty fire stills conforming to the Bureau's specifications were inspected for minor defects, and 12 demonstration charges were run. Twelve new still settings were built according to the Bureau's recommendations, seven under the direct supervision of the cooperative agent and the others by brick masons instructed by him. Nine new turpentine separators and dehydrators were installed, three under the direct supervision of the cooperative agent. Two still thermometers were installed, one was taken out, adjusted, and reinstalled, and two were checked for accuracy against a portable test thermometer.

In Georgia, 160 visits were made to naval stores producers, factors, county agents, and timber owners in connection with naval stores problems. Stilling demonstrations were given at a number of producers' plants to instruct stillers in the Bureau's method of regulating distillation according to thermometer readings and water-spirits ratio of the distillate. The cooperative agent supervised the construction of 13 complete fire-still settings according to the plans and specifications of this Bureau and gave advice in the construction of 3 others. He also supervised the construction of one double-still shed and one single-still shed and the installation of eight automatic turpentine separators and dehydrators and two still thermometers. Thirty-seven sets of plans and specifications were distributed for various pieces of equipment.

NAVAL STORES STATISTICS

In compliance with the act of Congress, effective August 15, 1935, which authorizes the Secretary of Agriculture to collect and publish statistics on turpentine and rosin, two statistical reports were compiled and published. One gave statistics as of September 30, 1937, and the other as of March 31, 1938, on production of turpentine and rosin of each class, stocks, exports, imports, and domestic consumption by industries. These reports were published more promptly after the closing dates of the half and full naval stores season than heretofore.

PROTEIN AND NUTRITION RESEARCH

DIGESTIBILITY OF PROTEINS

The proteins of raw soybeans alone do not promote satisfactory growth of animals. However, a diet of cooked soybeans or of cooked soybean meal or of raw soybeans to which a little cystine has been added enables animals to grow very satisfactorily. This improvement in the nutritive value of raw soybean proteins resulting from the addition of cystine might lead to the belief that soybean proteins are deficient in this amino acid. That soybean proteins contain a relatively large quantity of cystine has been shown repeatedly by analysis. In order to solve this apparent anomaly and other perplexing problems pertaining to the nutritional properties of soybean proteins, studies on the digestibility of these proteins in vitro were undertaken. It was found that after long periods of tryptic digestion of soybean proteins no free cystine could be detected in the digest, although casein readily liberated all its cystine when digested with trypsin. This result indicates that the cystine of soybeans is chemically bound in a protein fraction that is very resistant to digestion and consequently not made available for assimilation, or that, if cystine is liberated by tryptic digestion, some substance in the digest interferes with its detection and determination.

Studies on the comparative digestibility, in vitro, of raw and cooked soybean proteins are being made to learn the nature of the change that takes place in soybean protein as a result of moist heating, whereby its nutritional value is so much enhanced.

DECYSTINIZED CASEIN

A large quantity of decystinized casein was prepared for use in studying its biological properties by feeding experiments and for a closer examination of its chemical composition and physical properties. Casein of a high degree of purity was first separated from fresh skim milk and then repeatedly dissolved in dilute alkali and reprecipitated each time with acid. After five such treatments the product showed no detectable amount of cystine when tested by the Sullivan method. Extended analyses showed that there was but little dif-

ference between the composition of the decystinized product and that of the original casein with respect to tryptophane, tyrosine, arginine, histidine, lysine, methionine, and total nitrogen. However, the decystinized product contained only 64 percent of the sulphur and only 46 percent of the phosphorus originally present in the casein. There was practically no difference between the digestibility of casein and that of the decystinized product as revealed by digestibility studies in vitro with trypsin.

A striking difference was noted between the physical properties of decystinized casein and those of untreated casein, particularly with regard to dispersion in dilute alcohol. Untreated casein is not dispersed in alcohol of any concentration at any temperature. The decystinized product soon becomes translucent and sticky in 30-percent alcohol at room temperature. At boiling temperatures, it is dispersed readily in 30-percent alcohol and somewhat less readily in 60-percent alcohol. It is not dispersed at all in absolute alcohol. It separates from hot, dilute alcoholic solutions on cooling and settles as a soft, sticky precipitate that assumes a rubberlike consistency after standing.

Feeding experiments were started to determine the biological value of decystinized casein. It is believed that it will find useful application in feeding experiments in which a cystine-free diet is desired.

It was found that ammonia when used instead of sodium hydroxide for purifying casein does not cause destruction of cystine.

AMINO ACIDS IN BEANS

The seeds of the bean family have a prominent place in the human dietary as a source of protein, and it is important to know their nutritional value in comparison with other protein-containing foods. It is well known that the relative nutritional value of different proteins depends on their content of certain amino acids, but the practical application of knowledge gained from analysis of pure proteins is difficult because proteins are always consumed in the form of staple foods, some of which contain several kinds of proteins. The method developed by the Protein and Nutrition Research Division for determining amino acids in staple foods and used previously in the study of white flour, whole-wheat flour, middlings, and bran was applied to the study of the navy bean, the lima bean, and the Rokusun soybean, a type recommended for human consumption. Navy and lima beans were found to be rich sources of most of the important amino acids, but they were deficient in cystine, which limits their nutritive value. For satisfactory utilization as protein food they must be eaten with other protein food that will supply sufficient cystine. Compared with navy and lima beans, the Rokusun soybean contains appreciably more cystine, tryptophane and tyrosine, but less histidine and lysine.

EFFECTS OF STORAGE ON PROTEINS OF GRAINS AND SEEDS

Immense quantities of grain and other seeds are stored, sometimes for long periods, and most of the meals and flours consumed have been subjected to the effects of storing and shelf-aging. Very little is known about the changes that take place in the proteins of these products during storage or the extent to which these changes may affect their nutritive value. Acquisition of such knowledge, as well as knowledge concerning the most favorable conditions of storage whereby undesirable changes may be reduced to a minimum, is highly important, especially in view of the consideration that is being given to long-time storage of surplus crops.

Continuation of the study on the effect of storage on the proteins of soybean oil meal and similar studies, inaugurated during the year, with wheat, whole-wheat flour, and white flour, revealed that striking changes occur in the proteins. After storage for only 1 month significant decreases in the solubility of the proteins and true protein content and an increase in amino nitrogen were observed. These changes, which increased with time of storage, indicated a marked break-down of the proteins, presumably by enzyme action. Soybean oil meal showed reduction in digestibility of its proteins after storage for 1 month, which became very marked after 12 months. On the other hand, wheat and wheat flour showed very little, if any, change in digestibility of proteins after 4 months of storage. In preliminary feeding experiments rats fed ground whole wheat that had been in storage in glass jars for 1 month at room temperature made better growth responses than did those fed on the same wheat freshly ground.

From the results of the experiments made thus far it appears that the proteins in whole seeds change less during storage than do those in the meal or flour prepared from them. The rate of change is greater for white flour than for whole-wheat flour. Greater changes occur in soybean oil meals stored in bags than in those stored in sealed jars, and in meals stored at room temperature (76° F.) than in those kept in cold storage (30°). However, the changes in cold storage were greater than expected.

VITAMINS

Research was continued in cooperation with the Bureau of Entomology and Plant Quarantine on the vitamin content of royal jelly, the special food which bees feed to their larvae in order to develop queens for their colonies. Assays showed that it contained very little, if any, vitamin A. It was found, however, that royal jelly is a good source of vitamin B, having about the same potency as wheat.

A critical review was made of the literature dealing with the value of soybeans as a source of vitamins, and the conclusions drawn from a survey of the most reliable publications were given in a mimeographed circular.

Work is in progress on the development of a satisfactory formula for providing an adequate vitamin supplement to diet used in feeding experiments with decystinized casein. Experimental trials of a new method for the assay of vitamin B_1 in feeds by noting the quantity required to cure polyneuritis in young rats in comparison with the quantity of thiamin required for the same purpose showed that the method is reliable and less time-consuming than the one in general use.

International standards for vitamins A, B_1, C, and D were supplied in limited quantities to vitamin investigators in the United States who are working in colleges, universities, and agricultural experiment stations.

ALLERGEN INVESTIGATIONS

Investigations on allergens of agricultural products were continued as part of the Department's program of basic research in agriculture, provided for in the Bankhead-Jones Act of June 29, 1935.

Many products and byproducts of agriculture, including foods, fibers, and plant pollens, are known to cause hay fever, asthma, and other allergic disturbances. The distribution, stability, and chemical nature of allergens present problems that fall naturally within the field of agricultural chemistry. Moreover, these problems vitally concern agriculture because they may seriously affect the utilization of certain agricultural products and byproducts.

In studies on ragweed pollen, it was found that the allergens of both short and giant ragweed are soluble in glacial acetic acid, as well as in water and saline solutions. The short ragweed allergen proved to be far less stable to heat than corresponding solutions of the cottonseed allergen, an appreciable decrease in activity resulting from heating the water extracts for 5 minutes at 90° C. Preliminary tests of the stability of the ragweed allergen towards enzymes were conducted with autolyzed yeast, urease, emulsin, taka diastase, erepsin, and papain. No appreciable destruction of the active agent was observed. Evidence of the presence of more than one allergen in short ragweed was obtained by heating the water extracts. Differences in heat stability of the active components are being studied to correlate their physiological and chemical characteristics.

Further experiments substantiated the observations made during the previous year that ragweed allergen is not transmitted in the milk of cows receiving the pollinating blossoms of short ragweed in their ration.

Examinations of the blood and blood serum from allergic and normal subjects showed no demonstrable differences with respect to specific capacity to inactivate the allergenic components of short ragweed pollen. Substrates obtained in these experiments are being tested to determine their value in comparison with undigested ragweed extracts for diminishing sensitiveness to the air-borne pollen.

In studies on the allergens of cottonseed and its products, an exceptionally potent allergenic concentrate was obtained from the water-soluble material of the kernels of raw cottonseeds by chemical fractionation. Pending identification of its constituents, this concentrate is designated simply as fraction CS–1. It was prepared from that portion of the water-soluble material of the seed pre-

cipitated by alcohol. Its principal components, protein and carbohydrate, were separated by precipitating the protein with picric acid. Allergenic activity of the cottonseed kernel appears to be due primarily to the protein component of the fraction CS–1, which in the form of the picrate retains its capacity to induce allergic reactions in certain hypersensitive individuals. The protein of fraction CS–1 was differentiated from previously identified proteins of the cottonseed. The previously known proteins were separated and shown to possess no important degree of allergenic activity. The allergenic component of the fraction CS–1 lost none of its specific activity when separated from the carbohydrate portion of the whole fraction. Dialysis of fraction CS–1 against water resulted in rapid migration of the allergenic constituent through the collodion membranes. A subfraction obtained by this procedure was shown by anaphylactic tests on guinea pigs to be distinct from the undialyzed substance. This evidence indicates the presence of more than one antigen in fraction CS–1.

Both fractions CS–1 and the picrate derived from it proved to be more specific in their action as allergens than unfractionated cottonseed extracts. Only those individuals who exhibited specific sensitiveness to CS–1 and CS–1 picrate by skin tests were found to be clinically sensitive to cottonseed.

No trace of the CS–1 allergen was detectable in concentrated extracts obtained from refined, edible, cottonseed oil. Allergic subjects who manifested a high degree of clinical sensitiveness to CS–1 and other nitrogenous derivatives of the cottonseed kernel experienced no unfavorable results from continual use of edible cottonseed oil as food.

In view of the fact that cotton linters obtained from old upholstery sometimes yield potent allergenic extracts which induce positive reactions in individuals sensitive to house dust, experiments were continued to determine whether the house-dust allergen is generated by deterioration of linters on aging. Clinical tests of extracts from six lots of cotton linters, portions of which had been stored for a year under different conditions designed to accelerate or retard deterioration of the fibers, yielded no evidence of the generation of a specific allergen in cotton linters as the result of aging. While some individuals manifested signs of sensitiveness to water extracts of cotton linters, there appeared to be no correlation between sensitiveness to the linters and to the kernel of the cottonseed, nor between sensitiveness to either of these products and house dust.

CHEMICAL ENGINEERING RESEARCH

AGRICULTURAL FIRES

Laboratory and field investigations were continued on the causes, results, and prevention of spontaneous heating in hay, which is one of the main causes of fires on farms. The results of previous experiments indicated that microbial action favored by a high moisture content is responsible for the early stages of heating, after which a purely chemical reaction is initiated. Under certain conditions this may increase heating to the point of ignition. It was believed that the formation of unsaturated, easily oxidizable products by the heat of microbial action was responsible for the chemical reaction that followed. This belief was given support by the results of experiments in which alfalfa hay was heated in an inert atmosphere (nitrogen) at a temperature slightly above the limits of bacterial activity. Such heating increased the oxygen absorption of the hay. The effect of heating at higher temperatures is now under investigation.

The gaseous products obtained when hay is heated, both in an inert atmosphere and in air, are being studied to throw further light on the nature of the decomposition. Some evidence was obtained that carbon monoxide, a combustible and poisonous gas, is formed in small quantities at a temperature only slightly above 100° C. A special gas burette was designed for use in determining small quantities of this and other combustible gases.

The results of the investigation on the nature of the fatty substances of alfalfa hay, which are largely lost as the result of self-heating, were prepared for publication. The material extracted from alfalfa meal with cold petroleum ether amounted to 2.1 percent, on a moisture-free basis, and contained unsaturated fatty acids (chiefly oleic, with small amounts of linoleic and linolenic acids), a complex mixture of saturated fatty acids (principally palmitic), primary alcohols, sterols, a mixture of paraffin hydrocarbons, and a viscous odoriferous oil. This oil, which appeared to be a complex mixture of terpene-like hydrocarbons, contained most of the carotenoid pigments and other fat-

soluble vitamins. The unsaturated acids, sterols, and carotenoids are very susceptible to oxidation in a heating haymow, and it is possible that these substances may be a contributing factor in the spontaneous heating of alfalfa hay.

A field study was made of haying practices and new types of hay storage designed to prevent excessive heating, on a number of selected farms on the Eastern Shore of Maryland and in Chester County, Pa. Special attention was given to such factors as moisture content, temperatures, air velocities, and gases in the stored hay. The need for thorough and systematic procedure in handling mows of hay that have developed excessive heat was emphasized by a fire, caused by spontaneous ignition of oat hay, which resulted in the complete destruction of a barn near Monroe, Wis., with a loss of about $10,000. The owner had observed that his hay was dangerously hot and on the day before the fire called in his neighbors to assist in wetting down hot pockets and removing the heating hay. This activity was continued until the forenoon of the next day, when it was thought that heating had been checked and the danger of fire was past. Fire broke out, however, early in the afternoon of the same day in hay remaining in the barn, with destructive results.

A member of the Chemical Engineering Research Division's staff conferred with representatives of eight State agricultural experiment stations with regard to current and contemplated investigations on the spontaneous heating and ignition of hay, with the officials of three manufacturing firms interested in the production of special equipment for the safe storage of chopped hay and silage, and with the representative of an instrument-manufacturing firm regarding temperature and relative-humidity indicators and anemometers for use in proposed experiments on stored hay.

In connection with studies on the prevention and control of farm fires from miscellaneous causes, an inspection was made of the fire-fighting equipment of a rural fire-protection association in Wisconsin. Information was obtained on the organization and operation of this association, which is a model for efficiency and effectiveness in providing fire protection for farmer subscribers within a radius of 10 miles.

Conferences were held with representatives of a cement-manufacturing firm on the design and construction of an underground concrete tank for storing water to be used by motorized apparatus in fighting farm fires, and with officials of an insurance company and of an organization interested in farm equipment concerning the explosion and fire hazard from static electricity when rubber tires are used on farm machinery, and the cause and prevention of fires in the new type of corn picker which is attached to the front of the farm tractor.

Much educational work on rural fire protection was done through conferences with State and local officials, editorial staffs of farm journals, chambers of commerce, and officials of insurance companies, through informal talks before groups of firemen, and through addresses before conventions of firemen's associations, general public meetings, the National Safety Congress, civic clubs, and meetings of students at schools and colleges. Special attention was given to the need for safety programs for rural schools and the inspection of rural electric wiring.

Members of the Bureau's chemical engineering staff cooperated with organizations interested in fire protection, by participating in conferences and meetings, and in the work of committees on which they held membership. These organizations included the National Fire Protection Association (committees on farm fire protection and spontaneous heating and ignition), the National Fire Waste Council of the Chamber of Commerce of the United States and its agricultural committee, the American Society of Agricultural Engineers (committee on fire prevention and protection), and the National Safety Council.

DUST EXPLOSIONS

Eleven major explosions in industrial plants, involving dusts from agricultural materials, were investigated by the Bureau. Four of these were caused by grain dust, and one each was caused by dusts of cereal products, mixed feed, cottonseed meal, soybeans, starch, derris root, and cotton floc. These explosions resulted in the death of 8 men, injury to 39, and property damage amounting to about $546,000.

Some of the explosions investigated afforded an opportunity to observe the effectiveness of safety measures recommended by this Bureau for reducing dust-explosion losses. The use of vents, such as hinged windows, or light wall

construction recommended for the release of explosion pressure proved particularly effective in limiting the damage from explosion in several of the cases investigated. Excessive damage from one grain-dust explosion was caused by insufficient venting area in a concrete section of the plant to which the explosion spread through a tunnel from a wooden elevator section. An outstanding example of the effectiveness of structural features recommended for reducing property damage from dust explosions was furnished by a grain-elevator explosion where the property loss was less than $20,000, although 6 persons were killed and 16 injured. Because of the special structural features the explosion was segregated and its force dissipated. If it had spread to all sections of the plant, there would have been much greater property damage, as well as greater loss of life and personal injuries. The fact that this explosion was caused by the ignition of grain dust by the flash from an electric motor shows the necessity of using explosion-proof motors in locations where explosive dust clouds may be present. One of the more serious grain-dust explosions, which occurred while a carload of corn was being unloaded into the elevator, appeared to have been caused by sparks produced when some hard foreign material in the grain struck the metal buckets or casing of the elevator leg.

In order to study the conditions under which metallic sparks ignite dust clouds, provision was made for the erection of a steel bucket elevator alongside the tower at the dust-explosion testing station at Arlington Experiment Farm. With this elevator in operation it will be possible to maintain a continuous dust cloud within the tower. This equipment can be used also in demonstrations to show the possibility of venting explosions in elevator legs and to explain the operation of vents designed to relieve pressure.

Tests were made at the dust-explosion testing station to determine the effects of moisture content and atmospheric humidity on the explosibility of dusts. The results of these tests will be coordinated with those of laboratory studies. Tests were also made to determine the explosibility of sodium resinate at different concentrations. Scored glass, used in the construction of explosion vents, was found to break at one-seventh to one-fifth the pressure required to break the same kind of glass when unscored. Dust explosion demonstrations were given at the testing station for individuals and organizations interested in the subject.

Laboratory studies to determine the effect of moisture content and atmospheric humidity on the explosibility of wheat elevator dust were completed, and most of the pressure curves have been analyzed. The moisture content of the dust was brought to equilibrium at definite temperatures and at different relative humidities between 0 and 100 percent. Explosibility tests were made both in dry air and in air having a relative humidity corresponding to that used to bring the moisture content of the dust to equilibrium. The effects of ash content and particle size on the explosibility of corn and wheat elevator dusts were determined. The results will aid in the selection of typical elevator dusts to be used in research on the effect of atmospheric humidity on the explosibility of these dusts.

Forty-three samples of dust were tested in the laboratory for explosibility. The following materials were found to form explosive mixtures with air: Feedmill dust; malt dust; flour middlings; bean-cleaning dust; cottonseed, linseed, and coconut oil meals; licorice and starch mixture; ginger, derris, and cube roots; pyrethrum; onion dust; garlic dust; paper dust; fiberboard dust; dust from rabbit fur; dust from cleaning crude drugs; resinates of lead, manganese, and aluminum; apple flour (at some concentrations); cellulose acetate; wood flour; molding compound containing equal parts of wood flour and phenol-formaldehyde resin; mixed raw materials for the molding compound; a urea-formaldehyde resin; another type of synthetic resin; and dust of rubber-compounding materials.

The results of the Bureau's work on prevention of dust explosions were presented at firemen's training schools and conventions of firemen's associations, and to city fire departments, student groups at high schools, colleges, and universities, and civic organizations.

In connection with their work on dust-explosion prevention, members of the chemical engineering staff cooperated with national organizations by participation in the work of committees on which they held membership. The dust-explosion hazards committee of the National Fire Protection Association, of which the chief of the Chemical Engineering Research Division is chairman, was assisted in the preparation of a leaflet, entitled "Fundamental Principles for Dust Explosion Prevention," and in the formulation of safety codes for

the prevention of dust explosions in sulphur plants and aluminum-manufacturing plants. Other committees of the same organization were assisted in the preparation of a code covering the installation of air-conditioning equipment and dust, stock, and vapor-removal systems, and in the revision of the safety code for fumigation of grain-storage and grain-processing plants and a brochure on static electricity. The committee on conveyors and conveying equipment of the American Standards Association was assisted in the preparation of a safety code covering air conveyors.

AGRICULTURAL ACCIDENT PREVENTION

At the request of the National Safety Council the chief of the Chemical Engineering Research Division, as a representative of the Department of Agriculture, accepted leadership in the organization of a new section on agricultural safety. Investigation by this section developed the fact that the number of accidental deaths is greater among agricultural workers than in any other industry. A statement was prepared and presented at the National Safety Congress in Kansas City, Mo., showing the urgent need for agricultural accident prevention. Representatives of various organizations attending the congress took action requesting the National Safety Council to organize a permanent section on agricultural safety. This movement is the first of its kind to be undertaken in the United States.

SERVICE WORK

One member of the chemical engineering staff was detailed during the entire year to the Naval Stores Research Division for engineering work in connection with investigations on the production and utilization of turpentine and rosin. Another made regular fire and safety inspections of the Bureau laboratories and gave special attention to the safe storage of inflammable solvents and other materials.

Most of the divisions of the Bureau were assisted by the preparation of designs and specifications for laboratory equipment and by drafting work, including graphs, charts, diagrams, drawings, curves, signs, and lettering. A report with drawings was prepared in connection with the work of a Bureau committee appointed to develop plans for a model chemical laboratory lay-out for field stations.

FERTILIZER RESEARCH

CATALYST AND HIGH-PRESSURE INVESTIGATIONS

In further studies on the kinetics of ammonia decomposition in the presence of hydrogen, it was found that with a singly promoted iron catalyst (containing 10.2 percent of alumina) increasing concentrations of ammonia tended to inhibit decomposition, while increasing concentrations of hydrogen tended to promote decomposition, in the temperature range of 385° to 445° C. This is a curious type of mechanism never observed previously by anyone working in the field of reaction kinetics. The fact that ammonia inhibits the reaction on the singly promoted catalyst but not on the doubly promoted catalyst (containing alumina and potassium oxide) explains the variation in pressure coefficient with different catalysts, which has been one of the most puzzling problems in the mechanism of ammonia synthesis. Since the reaction is reversible, a ratio of reacting substances that favors decomposition would also favor synthesis under different conditions of temperature and pressure. For a long time it was known that the efficiency of both singly promoted and doubly promoted catalysts for ammonia synthesis is high at atmospheric pressure and that at higher pressures the efficiency of the singly promoted catalyst drops rather rapidly, while that of the doubly promoted catalyst remains practically constant. The cause of this difference is now apparent, since ammonia retards the reaction on singly promoted catalysts but does not do so on doubly promoted catalysts.

The method which was developed originally for measuring the surface areas of iron synthetic ammonia catalysts by determining the adsorption isotherms of gases near their boiling points and which, as reported last year, has been used for measuring the surface areas of soils and soil-colloid particles, was found to be universally applicable to all adsorbent and finely divided materials. It was applied to unreduced magnetic iron oxide catalyst and also to a decolorizing carbon adsorbent that had a surface area per unit weight 100,000 times as great as that of the iron oxide. This method has wider applicability, is more

accurate, and requires less complex apparatus than any other method suggested thus far for measuring surface areas of finely divided particles.

The yield of oxides of nitrogen when nitrogen-oxygen mixtures are subjected to an ozonizer discharge at atmospheric pressure was found to increase with temperature, reaching a maximum at 70° to 100° C. Above 100° the yield at first decreased, but increased again with continued rise in temperature, finally becoming fairly constant. The behavior in the temperature range of 70° to 100° was caused by extremely rapid thermal decomposition of the nitrogen pentoxide existing at lower temperatures. At higher temperatures only the lower oxides of nitrogen were present.

FUNDAMENTAL PHYSICAL AND CHEMICAL INVESTIGATIONS

X-ray studies on the structure of soil minerals revealed that most of the common minerals present in the colloid fraction of soils have structures related to that of mica. The individual layers are superimposed in a somewhat random manner, a property that has been observed previously only in compounds that form liquid crystals. It was found that in clay mineral hydrates, such as bentonites, the water molecules are present in layers which owe their stability to the arrangement of oxygen ions of the mineral surfaces. The retention of uncombined water by clays and the swelling of bentonites in contact with water are also determined by this structural property.

The marked association of phenol in carbon tetrachloride solutions, in the range of 0.1 to 0.5 molal, was studied quantitatively by means of the infrared spectrograph. Halogen substituted phenols exhibited noticeably less association than phenol itself.

Ultraviolet absorption coefficients were determined on 15 derivatives of uracil and cytosine. The results showed that such measurements are a valuable aid in identifying urea derivatives of this type, which occur naturally in all kinds of cellular organic matter.

An estimation of the intensity and position of the far ultraviolet absorptions of nitrogen was made on the basis of existing data for the dispersion of nitrogen and the positions of the molecular levels. This concerns a spectral region that for practical purposes cannot be measured quantitatively. From the results a calculation was made of the sunlight absorbed by nitrogen in the atmosphere. It seems certain that this absorption leads to the formation of nitrogen oxides in the high atmosphere, but the amounts formed are difficult to estimate.

NITROGENOUS FERTILIZER MATERIALS

Treatment of peat with ammonia under conditions for obtaining a fertilizer material showing optimum activity of insoluble nitrogen yielded a product containing only 6 to 8 percent of total nitrogen. With the purpose of increasing the nitrogen content without producing a potentially acid fertilizer, commercial calcium cyanamide, an alkaline nitrogen carrier, was added to the ammoniated peat, and the mixture was treated in various ways. Under some conditions cyanamide forms urea, a desirable product, but under other conditions it forms dicyanodiamide, which is toxic to plants. In the experiments 30-percent conversion of cyanamide nitrogen to urea, the highest value observed, was obtained by treatment with sulphuric or carbonic acid. In view of this relatively low conversion, it appears impracticable to employ this method to raise the nitrogen content of ammoniated peat. In experiments along another line of attack, the nitrogen content of ammoniated peat was increased to between 10 and 15 percent by pretreating moist peat with chlorine gas at 28° C., boiling the chlorinated product with water to partly replace the chlorine with hydroxyl ions, and then ammoniating to replace the hydroxyl ions with NH_2 groups. Direct ammoniation of chlorinated peat gave a product containing about 10 percent of nitrogen, 55 percent of which was water soluble and the remainder highly active by chemical tests.

It was previously reported that the coating of urea crystals with small amounts of finely divided material, such as lime or calcium carbonate, reduced their tendency to absorb moisture from the air and to cake on storage. Urea crystals treated in this way are still able to react with fertilizer salts containing water of crystallization to form double salts, at the same time liberating water and producing a sticky mass. Attempts were made, therefore, to form a continuous coating over the surface of urea crystals to act as a deterrent or preventative for such action. The formation of urea-aldehyde resin coating on the surface of the crystals gave good results, but the heat treatment required

for hardening the resin makes the process too costly. The formation of a thin layer of ammonium phosphate or ammonium sulphate on the surface of the urea crystals was found to be an efficient and practical method for obtaining a continuous, adherent coating. The effects of such treatment were very different from those obtained by mixing the same quantity of the ammonium salts with urea crystals. Urea coated in this way has little effect on magnesium sulphate containing seven molecules of crystallization, but will still take up water from moist air and may cake on storage. This property was effectually overcome by employing on oil coating. Both types of coating are essential to prevent hygroscopic absorption and release of free water when urea is in contact with hydrated salts.

BIOCHEMICAL AND ORGANIC NITROGEN INVESTIGATIONS

Studies were made to gain information on the question of whether all the nitrogen consumed by *Azotobacter* is retained within the bacterial cells or part of it is excreted as soluble nitrogen compounds into the surrounding medium. From this work it appears that even in the youngest cultures not less than 10 percent of the nitrogen is excreted. This was true both for cultures grown in free nitrogen and those grown with fixed nitrogen. The presence of various trace elements did not increase the proportion of nitrogen excreted. Cultivation of *Azotobacter* in bags of cellulose film surrounded by a sevenfold greater amount of cell-free medium outside than inside produced no appreciable change in the efficiency of growth, the rate or amount of nitrogen fixed per unit volume, or the amount of the various nitrogen compounds excreted.

Numerous *Azotobacter* cultures were tested for the presence of hydroxylamine and oxime, which certain investigators have claimed are intermediate products in the biological nitrogen-fixation process. Only one, *A. vinelandii*, gave an occasional test for hydroxylamine, which apparently was present in small concentration. Three cultures were found to produce oxime, whereas a dozen others gave no test for this compound.

Experiments on the growth of legumes in close proximity to nonlegumes were carried out in a sand medium, using nitrogen-free nutrients and artificial illumination, to test the effect of several variables, not included in previous experiments, on the excretion of nitrogen compounds from growing legume nodules. The nonlegumes did not thrive. Excretion of nitrogen was not induced by an increased ratio of nonlegumes to legumes, by altering the proportions of mineral food materials in any one of a number of ways, or by increasing the particle surface of the sand. These negative results agreed with those previously published by the Bureau.

The presence of coenzyme R, the growth accessory discovered by the Bureau several years ago, was found to be necessary for appreciable growth of 19 typical strains of *Rhizobium meliloti*, *R. trifolii*, *R. phaseoli*, and *R. leguminosarum*. Neither reducing substances, such as thioglycollic acid and cysteine, nor iron could take the place of this growth-stimulating substance. The need for this factor was evident whether the nitrogen source was nitrate, ammonia, or asparagin. An occasional strain of rhizobia has been found that can synthesize coenzyme R.

From experiments in the culture of *Azotobacter vinelandii* on a medium made from highly purified salts and sucrose, in comparison with media made from ordinary commercial materials containing traces of impurities, it appeared that these bacteria can synthesize all the organic materials required for their essential metabolic processes, except simple nonspecific organic materials which seem to serve only as sources of energy.

In cooperative studies with James Bonner of the California Institute of Technology, it was found that as much as 0.14 mg of vitamin B_1 per gram of cell matter is synthesized by *Azotobacter*. There is, therefore, more of this vitamin in *Azotobacter* than in yeast, which is one of the main sources of vitamin B_1. The synthesis of vitamin B_1 in soils by *Azotobacter* may be of fundamental agronomic importance, since this vitamin has a stimulating effect on the growth of plants. A yellowish-green pigment isolated from the medium in which *Azotobacter* organisms grew was found to belong to the flavin type and to be related to, or identical with, vitamin B_2. From 0.7 to 1.0 mg of this pigment was present in 1 liter of medium. The characterization of this flavin complex is of interest because of the probable identity of the pigment with the Warburg yellow respiration ferment, which is an active participant in the liberation of energy from carbohydrates by the organism.

Further research on the possibility of fixing nitrogen by reaction with organic compounds apart from life processes showed that diphenyl acetylene combines with activated nitrogen to form a brown solid containing 16 to 18 percent of nitrogen. It appears to be a complex compound of high molecular weight. Tetrahydronaphthalene and benzonitrile were also found to react with atomic nitrogen to form amorphous nitrogenous solids having physical properties similar to those of the product from diphenyl acetylene. The reaction of isoprene with active nitrogen gave a nitrogenous liquid of low boiling point.

PHOSPHATES

Studies on the fluorine content of phosphate rocks from commercial deposits throughout the world showed that fluorine is a common constituent of phosphate rock; that within certain limits the fluorine content varies with the age of the phosphate deposit (being greater in the older ones), and that there is a close relationship between the fluorine and phosphorus contents of samples from different deposits of the same type. Analyses of many samples of phosphate rock from Idaho, Montana, Utah, and Wyoming showed that the western phosphates are high in fluorine but that their fluorine-phosphorus ratios are usually about the same as those for phosphates in other sections of the United States. The Willard and Winter method for determining fluorine was modified to prevent interference by chlorides, sulphides, and organic matter.

From a study of the relationship between the fluorine content of different types of phosphate rock and their solubilities in neutral ammonium citrate and in 2-percent citric acid solutions, it appeared that differences in the fluorine content, while an important factor, are not alone responsible for the differences in solubilities. It is believed that the results of this study will aid in the selection of types of phosphate rock best suited for direct use as fertilizer.

In the investigation on the composition and properties of superphosphate, it was found that the type of phosphate rock used, the ratio of sulphuric acid to rock, and the age of the superphosphate, all influence the solubilities of phosphorus, fluorine, iron, aluminum, and other constituents in water and in neutral ammonium citrate solution. There were no important changes in the solubilities of constituents after the superphosphate was 60 days old, and the greatest changes occurred within the 30-day period following preparation of the superphosphate. These changes were generally in the direction of increased solubilities in both solvents. Free water and free phosphoric acid decreased during aging, whereas water of crystallization showed little or no change.

The form of the calcium sulphate produced as a constituent of superphosphate when phosphate rock is treated with sulphuric acid was found to depend principally on the concentration of the acid and the temperature of the reaction mixture. Gypsum was the predominant form of calcium sulphate produced when the initial concentration of the acid was 44° Baumé and the temperature was kept below 20° C. Higher concentration of acid and higher temperatures favored the formation of hemihydrate and anhydrous calcium sulphate. With acid concentrations of 50° to 55° Baumé and temperatures of 105° to 110°, usually encountered in commercial manufacture of superphosphate, anhydrous calcium sulphate was either the predominant or only form of calcium sulphate produced. Transformation of the hemihydrate and of anhydrous calcium sulphate into gypsum did not occur to a marked degree when superphosphate was stored for long periods at atmospheric temperatures, when superphosphate was granulated, or when superphosphate was treated with anhydrous ammonia.

In comparative experiments on the fixation of inorganic phosphate (monopotassium phosphate) and organic phosphate (sodium glycerophosphate) by different types of soil, it was found that in Cecil clay the organic phosphate is converted to an insoluble form almost as rapidly and completely as the inorganic phosphate. In contact periods not exceeding a few days, only a minor amount of inorganic or organic phosphate was immobilized in Norfolk loam, whereas a minor portion of the organic phosphate and a major portion of the inorganic phosphate were converted to the insoluble condition in Las Vegas loam (containing about 0.5 percent of alkali). When the time of contact was increased, the percentage of organic phosphate immobilized increased. Experiments on fixation in sterilized Norfolk and Las Vegas soils and a study of the rate of conversion of organic phosphate to soluble inorganic phosphates in the raw soils showed that the increase of fixation of organic phosphate is essentially a secondary reaction, namely, the fixation of inorganic phosphate

formed by the action of soil micro-organisms on the organic phosphate. Several organic phosphates were synthesized for further studies on the rate of hydrolysis of organic to inorganic phosphate.

POTASH SALTS AND BYPRODUCTS

A study of methods for producing potassium nitrate from potassium chloride and nitric acid through the intermediate formation of potassium pentaborate showed that excessive quantities of boric acid were required to obtain satisfactory yields of the potassium borate when potassium chloride and boric acid were reacted directly in an atmosphere of steam at temperatures above 100° C. Moreover, much of the boric acid was volatilized with the hydrochloric acid formed. In the reaction between aqueous solutions of potassium chloride and ammonium borate the temperature-solubility relationships of the system were found to be favorable to the separation of potassium pentaborate and ammonium chloride by fractional crystallization. Potassium pentaborate obtained by either method may be readily converted to potassium nitrate and boric acid by reaction with nitric acid. The boric acid may be recovered and used again for preparing additional potassium pentaborate.

Nitrosyl chloride, a byproduct of one of the processes for converting potassium chloride to potassium nitrate, was found to be readily oxidized by nitric acid-sulphuric acid mixtures at temperatures between 40° and 90° C., with the formation of nitrosyl sulphate and chlorine. It was also readily oxidized to nitric oxide and chlorine when gaseous mixtures containing it and either nitric acid or oxygen were passed over activated silica maintained at a temperature of from 45° to 190°. The nitrogen and chlorine contents of nitrosyl chloride must be recovered and utilized for economic operation of the process in which this byproduct is formed.

A series of potassium metaphosphate products, prepared from potassium chloride and phosphoric acid at temperatures up to 800° C. and analyzed for total phosphate by the molybdate method, for metaphosphate by the barium chloride method, and for pyrophosphate by the zinc sulphate method, showed increasing amounts of metaphosphate and decreasing amounts of free phosphoric acid, pyrophosphate, and orthophosphate with increasing temperatures of preparation. Products prepared at 300° contained less than 0.2 percent of the water-insoluble form of potassium metaphosphate, whereas those prepared at 350° contained 73 to 74 percent, and those prepared at 800° contained 91 to 92 percent. Incidental to this work it was necessary to make an extensive study of methods applicable to the determination of the relative proportions of orthophosphates, metaphosphates, and pyrophosphates in phosphate products.

Vegetative tests in which potassium metaphosphate, supplemented by muriate of potash, was the source of potash and phosphoric acid in a 4–8–7 fertilizer mixture showed that the metaphosphate is equivalent to other sources of potash and phosphoric acid in fertilizing value.

Further studies were made on the physical and chemical properties of monocalcium chlorophosphate, the potential fertilizer material previously discovered by the Bureau in efforts to utilize the hydrochloric acid obtained as a byproduct in the conversion of potassium chloride to other potash salts. When this compound was heated for long periods at 120° C. it lost water of crystallization and was converted to the anhydrous form. At temperatures of 200° to 300° one-half mol of hydrochloric acid and two-thirds mol of water per mol of chlorophosphate were liberated, after which decomposition apparently ceased. At 500° the monocalcium chlorophosphate was completely decomposed to calcium pyrophosphate. When steamed at 250° approximately equivalent quantities of hydrochloric acid and water were liberated, and dicalcium phosphate was formed.

Monobarium chlorophosphate, prepared by treating dibarium phosphate with hydrochloric acid, was similar to the calcium salt in being water soluble and giving solutions neutral to methyl orange. This salt is anhydrous, whereas the calcium salt normally contains one molecule of water of crystallization.

Decomposition of Florida pebble phosphate rock with a mixture of sulphuric and hydrochloric acids yielded monocalcium chlorophosphate and calcium sulphate as the principal products and eliminated only a small portion of the fluorine by volatilization. Ammoniation of the mixed product with aqua ammonia equivalent to the chlorine content resulted in the conversion of the chlorophosphate to dicalcium phosphate, ammonium chloride, and water. The water was vaporized on drying, so the product after ammoniation weighed less, but contained more plant food, than it did before.

MIXED-FERTILIZER INVESTIGATIONS

Granulation of fertilizer mixtures by the method of rotary drying was found to be affected by the moisture content of the mixture, temperature during granulation, the ratio of organic to inorganic components, the physical properties of the components, and the fineness of the particles before granulation.

The pressure required to crush a fertilizer granule was found to vary with size, shape, moisture content, and the conditions under which it was prepared. The composition of a granulated fertilizer mixture of the ordinary type had less effect on the hardness of the granules than did the conditions of granulation, such as original particle size, moisture content, and temperature. The crushing strength of fertilizer granules decreased with increase of moisture content, the effect of moisture being more marked with some mixtures than with others. In the case of spherical granules, crushing strength was approximately proportionate to the square of the diameter.

Differences in the size of the fertilizer granules produced in the granulating process involved only slight variations in the composition of the individual granules when the mixture was ground to pass a 40-mesh screen prior to granulation. Variation in the composition of granules of different size was much greater in the case of mixtures containing coarse particles previous to granulation.

High-analysis commercial fertilizer mixtures containing 40 percent of plant food had about the same effect as low-analysis fertilizer mixtures on the concentration of the soil solution when equivalent quantities were used. Commercial fertilizers formulated with urea-ammonia liquor had less effect on the concentration of the soil solution than did those of the same grade formulated with Nitrogen Solution II. Differences in the effects of similar fertilizer applications on the effective concentration of the solution in soils of different types were found to depend on relative moisture contents of the soils.

In studies of the reactions of calcined phosphate with urea phosphate, it was found that dicalcium phosphate and free urea are formed by the primary reaction of the urea phosphate with the alpha-tricalcium phosphate in the calcined phosphate and possibly other products by a slower secondary reaction between dicalcium phosphate and any remaining urea phosphate. The mixed product is less hygroscopic than urea phosphate and contains more plant food than does calcined phosphate. If proper proportions of the reacting materials are used, the product is neutral or acid in reaction. This permits its admixture with ammonium salts, thus removing one of the principal objections to calcined phosphate.

In a study of the composition of the citrate-insoluble phosphates formed during storage of ammoniated fertilizer mixtures containing dolomite, it was found that the dicalcium and tricalcium phosphates in freshly ammoniated superphosphate are partly hydrolyzed to calcium hydroxyphosphate during storage at temperatures above normal and that the presence of dolomite increases this tendency. In the presence of fluorine the reactions proceeded to the formation of fluorapatite, even at ordinary temperatures. Increase in citrate-insoluble phosphoric acid in ammoniated mixtures stored at normal temperatures is therefore due mainly to the formation of fluorapatite; in mixtures stored at elevated temperatures it is due to the formation of both fluorapatite and calcium hydroxyphosphate. The proportions of these citrate-insoluble phosphates formed during storage depend on basicity of the mixture, moisture and fluorine contents, concentration of reacting components, and temperature and time of storage.

The citrate-soluble magnesium in samples of dolomite representing different sizes of particles and different degrees of reactivity, prepared for use in the study of the availability to plants of magnesium in dolomite, was found to increase regularly with the diminishing size of the particle.

A determination from statistical data of the equivalent acidity of commercial mixed fertilizers and the quantities of liming materials consumed during the period 1929–36 showed that the equivalent acidity of mixed fertilizers increased from 115 pounds of calcium carbonate per ton in 1929 to 152 pounds in 1933, and then decreased rapidly to 19 pounds per ton in 1936. That the recent drop in acidity is largely due to the use of liming materials, chiefly dolomite, is indicated by the fact that the consumption of such materials for mixed fertilizers increased from 34,000 tons in 1929 to 303,000 tons in 1936. The Bureau's research and publications on mixed fertilizers have been instrumental in furthering this desirable change.

From statistical and analytical data it was estimated that the average composition of commercial mixed fertilizers in 1935 was 3.44 percent of nitrogen, 9.36 percent of phosphoric acid, and 5.45 percent of potash, or a total of 18.25 percent of plant food. This slight gain in total plant-food content over the 18.17 percent found for 1934 indicates a continued trend toward higher analysis fertilizer mixtures.

SOIL CHEMISTRY AND PHYSICS RESEARCH

LIMESTONE SOILS

The study undertaken to determine what differences could be detected by chemical means between the various soils of limestone origin in the great valley extending from Pennsylvania to Alabama was completed, and the results were prepared for publication as a technical bulletin. In correlating the variations in soil composition with the factors of soil genesis it was concluded that differences in climate and parent rock were responsible for the variations noted. Climatic differences were responsible for the broad differences in composition between soils of the northern and southern ends of the valley, whereas variations in parent rock were responsible for local variations in soil composition. It was found that the total amount of bases present in the soil colloids correlated closely with the productivity of the soils.

ALLUVIAL SOILS

In the study of alluvial soils particular attention was given to 14 samples of sedimentary material deposited by the Ohio River flood of January 1937 and collected at different points along this stream. Mechanical and chemical analyses of these samples and extraction and analysis of their colloids have been completed, and the results are being prepared for publication. The sedimentary material was found to be very uniform in both chemical and mechanical composition. It was slightly calcareous and rich in the bases. Typical analytical values, nearly the average for all the samples, were as follows in percentage: Calcium oxide, 1.15; magnesium oxide, 1.27; potassium oxide, 2.52; sodium oxide, 0.50, and phosphoric oxide, 0.20. Every sample had a pH value above 7.0, indicating alkaline reaction. The colloidal fraction was very much higher in phosphorus and moderately higher in potash than the whole of the deposited material. The silica-sesquioxide ratio was about 2.1:1 and was remarkably uniform in the different samples. The average clay content was about 26 percent, and most of the clay particles were essentially submicroscopic. The silt content was very high and fairly uniform, around 65 percent.

SUBTROPICAL SOILS

In order to determine the physical and chemical properties of certain soils of the subtropics and the relationships between such soils and those of the United States where temperatures are not so high, an investigation was made on six Mexican soil profiles. The results, which have been prepared and submitted for publication, indicated that all the great soil groups are represented by the soils of Mexico, which have their counterparts in the United States both with regard to profile development and the chemical composition of their colloids. This information supplements data previously reported for soils within the United States showing the influence of certain climatic factors on soil classification characteristics and chemical composition.

In the investigation of soils from Hawaii, analyses were made of samples of soils and colloids representing 14 soil profiles. In the course of the analyses it was found that all these soils contained small but significant quantities of chromium, ranging from 0.2 to 0.3 percent as chromium oxide. The results of the investigation were published in Technical Bulletin 584.

DESERT SOILS

A study was made of the chemical and physical differences in the horizons of desert-soil profiles to learn the relation of these properties to the genesis and morphology of such soils and also to provide information on their agricultural value and treatment under irrigation and dry-land farming. The results indicated that the chemical composition of the soil colloids may be used to differentiate the various parts of the desert-soil profiles. Although differ-

ences within the soil profile were not so great as in areas of greater rainfall, they were distinct. There was sufficient moisture at a depth of 1 to 2 feet to cause marked, although incomplete, hydrolysis of the primary minerals. For the most part, calcium carbonate had been removed from the upper horizon and deposited at lower levels, and soluble salts were usually less than 500 parts per million in the soils of unimpeded drainage. Definite profile formation was indicated by concentration of clay between the first and second foot and by a change in chemical characteristics at this level.

NONFERTILE SOILS

Further work confirmed previous observations that the composition of the ash from leaves of trees growing on different soils is profoundly affected by the reaction and composition of the soils. The aluminum and manganese contents of tree leaves are governed by the degree of soil acidity and show very little relation to the quantities of these elements in the soil. On the other hand, the calcium content varies according to the quantity of calcium in the soil. The effect of the composition of soil on that of plants was strikingly illustrated in the case of a hickory tree growing on a soil formed from a vein of pegmatite containing rare-earth minerals. Analysis of the ash from leaves of this tree showed that it contained 0.2 percent of rare-earth oxides. Hickory leaves from a sandy Podzol soil contained no rare-earth elements. Incidentally, over 50 of the chemical elements were identified in the ash of hickory leaves from the pegmatite soil.

Determinations of arsenic in soil profiles representing various members of the great soil groups indicated that arsenic is present in small quantities in all soils. The quantities found ranged from 0.2 to 38 parts of arsenic per million parts of soil. The smallest quantities were found in the Podzol and coastal plain sandy soils, and the largest quantity was found in a Mexican soil. So far, no plant growing in soils to which arsenic has not been added has been found to contain arsenic in excess of 10 parts per million. Plants growing on soils to which liberal quantities of lead arsenate have been added take up arsenic in the leafy parts ranging from 1 or 2 to a maximum of 14 parts per million. Plant roots take up more. For example, mustard roots were found to contain 24 parts of arsenic per million. Although the search has not been exhaustive, no plant has yet been found which accumulates arsenic similarly to several plants that accumulate highly toxic quantities of selenium from soil. Apparently soils having excess soluble arsenic kill plants instead of producing healthy vegetation containing enough arsenic to be toxic to animals.

SELENIUM IN SOILS

Pot experiments with plants were made to determine the effect of soil colloids on the toxicity of different forms of selenium. Less than 1 part per million of selenium as selenate reduced the growth of millet in quartz sand by one-half, even when the sulphate supply was high. In soils of widely different character the selenate was only a little less toxic than in quartz sand. Since there is evidently no appreciable fixation of the selenate by most soil colloids, this form of selenium should have about the same toxicity in nearly all soils. Sodium selenite behaved quite differently from the selenate. Its toxicity was not affected by sulphate concentration but was affected by the colloidal material of the soil. The extent to which the selenite radical is fixed in an unavailable form by different soil colloids is still under investigation.

PHYSICAL PROPERTIES OF SOILS

Data obtained in a study of the densities of separate horizons of soil profiles, representing various members of the great soil groups, indicated that in most of the groups the density of soil minerals is at the minimum in the A horizon and the maximum in the C horizon. The density of the organic fraction in the A horizon is about 1.4 for the Podzol group and about 1.6 for the Gray-Brown Podzolic, Chernozem, Prairie, Red, and Laterite groups. This difference in density probably indicates fundamental differences in the character of the organic matter developed under different soil-making processes.

Density measurements on soils obtained when organic liquids were used instead of water as the pyknometer liquid varied less than 0.5 percent from those obtained when water was used. This close agreement tends to invalidate the opinion, often expressed in soil literature, that water is held so tightly

in soils that it is compressed and held by forces corresponding to a pressure of many thousands of pounds. It appears that water is held no more tightly than other liquids.

In the study of surface relationships in soils it was concluded that the variations in specific surfaces of soils and their colloids, as revealed by their absorption of gases, are not related to chemical composition or to the characteristics which determine classification in the great groups of soils. It was also concluded that heat of wetting and base-exchange capacity are not dependent on extent of surface alone.

In the groups of soils studied the average particle diameter of the colloidal fraction was found by the method used to range from 0.028 to 0.052 micron.

Further attention was given to the measurement of freezing-point depression as a means of gaining information concerning the moisture-retaining capacities of soils. When the Beckmann technique is used for measuring freezing-point depressions of soils, it is usually impossible to obtain results at moisture contents much below 10 percent. With the dielectric constant method this difficulty does not exist, and values for freezing-point depression as great as 8.4° C. have been obtained. Last year a technique was developed that apparently avoids difficulties due to supercooling.

From a study of samples from 12 soil profiles with regard to the volume of material that settles from suspensions in water and other liquids, it was found that the physical and chemical properties that determine the settling volumes of soils also control other soil characteristics, such as swelling and shrinkage, and are related to the movement of soil water.

Thermal-conductivity measurements with specially designed apparatus were made on 11 complete profile samples, representing various members of the great soil groups and three peats in the dry state. The values, expressed as calories per square centimeter for a temperature difference of 1° C. per centimeter, ranged from 0.000120 for peats to 0.000572 for sandy soils. The relation between porosity and thermal conductivity was found to be linear.

MINERAL COMPOSITION OF SOIL COLLOIDS

A number of soil colloids were examined by X-ray methods, both before and after removal of iron oxide, and the following mineral constituents were identified in some or all of them: Kaolinite, goethite, hematite, quartz, hydrous mica, and montmorillonite. The content of potassium was found to parallel that of hydrous mica. It is now possible to determine, within certain limits, the amount of a given constituent present. In most cases the crystalline constituents, as revealed by X-ray examination, compose 95 percent of the total colloid.

STRUCTURE OF PEAT

A number of representative types of peat and muck were investigated, and their acidic properties were determined both qualitatively and quantitatively. There were significant differences between different types of peat and also between different fractions of the same peat with regard to their total base-neutralizing capacities as shown by titration curves. The ratio of ammonia absorption to total base-neutralizing capacity appeared to be of special significance with regard to the quality of the acid constituents. Low ratios are believed to indicate the presence of predominantly weak acids, while relatively high ratios, obtained with sedimentary peat, woody peat, and muck, are believed to indicate the presence of stronger acids. The differences in acidic properties of various peats are undoubtedly related to their capabilities of supplying or conserving nutrients for plant growth when used as soil amendments and to other direct and indirect physiological effects upon plant growth.

QUICK CHEMICAL TESTS FOR SOILS

In the study of quick chemical tests for soils, analytical data were obtained by various methods on soils from several series of experimental plots in different States. Attempts to correlate the results of such tests with the fertilizer treatments and crop yields known for periods of from 5 to 40 years showed that there is no satisfactory method for judging from the results of quick tests the extent to which stimulation of crop growth may be expected from additions of various quantities of fertilizer ingredients to the soil. The tests serve to supplement the field information of experienced agronomists, but when taken alone may be very misleading.

In the investigation of electrical conductivity tests on soil extracts in relation to crop yields it was found that conductivity values may be useful for comparative purposes but are of very limited usefulness when considered alone. The best prospect for useful application of such tests is in the testing of very sandy soils, but such application has not yet been worked out.

SERVICE WORK

The service work of the Soil Chemistry and Physics Research Division includes chemical and mechanical analyses of soils, nitrogen determinations for the entire Bureau, and special physical and chemical determinations on soils. During the year such service work included about 160 complete chemical analyses of soils and soil colloids, about 1,600 nitrogen determinations, and about 750 mechanical analyses of soils. Most of the chemical analyses of soils were made in connection with research activities of the Division, although some were made for the Soil Conservation Service, the Bureau of Plant Industry, the Department of Justice, and several State officials. Out of the total number of mechanical analyses, 277 were made for the Soil Survey Division, 177 for the United States Housing Authority, and 45 for the Soil Conservation Service. The remainder were made for other organizations and for research projects within the Division.

SOIL SURVEY

Soil is the basic resource of agriculture. Since there are thousands of soil types in the United States with individual capabilities for use and responsiveness to management, accurate soil maps are essential to agricultural planning. Never before have the results of this research been in greater demand. Not only is there great need for the existing maps and for new maps in areas for which some are now available, but the interpretation of these in specific terms, applicable to problems of agricultural adjustment, has required greatly increased attention by scientists of the Soil Survey Division.

OBJECTIVES

The object of the soil survey is to classify and map the soils of the United States and to describe their characteristics, particularly in reference to the growth of various crops, grasses, and trees. The ultimate purpose of this research is to provide accurate soil maps of the country. These maps are necessary for the classification of rural lands, and for the factual basis in the development of rational programs of land use consistent with conservation and the welfare of the agricultural people, whether planned by public agencies or individual farmers. The work comprises the determination of the character of soils, definition of soil types, development of a uniform system of soil classification, delineation upon maps of the boundaries of each soil type, and the interpretation of the capabilities of the soils for the production of crops, grasses, and trees under different kinds of management.

Approximately 23,000 square miles of rural lands in the United States and Hawaii were mapped by the Soil Survey Division during the past year. The total area covered by the soil survey is more than one-half the arable lands of the Nation. The soil maps, together with the accompanying reports giving descriptions of the soils and their uses, provide farmers, research workers, extension leaders, and local officials with a practical working handbook of the land for the area covered. In order that the results of experiments on farm land may be utilized in connection with land use problems, it is necessary that information be given regarding the type of soil on which the experiments are made. Once an accurate map of the soil types is made, the results may be extended to individual farm areas having the same soil types. The continued extension in the use of soil maps wherever they are available for determining land use policies testifies to their accuracy and value.

STATE COOPERATION

All this research is accomplished in direct cooperation with local agencies, especially the State agricultural experiment stations. In this way both the broader perspective of the Federal organization and the more detailed local knowledge of the State agencies are utilized to the best advantage, each supplementing the other. For example, the Bureau is cooperating with the seven States having responsibilities for the programs of agricultural development in

the watershed of the Tennessee River. The agricultural experiment stations of these States are cooperating also with the Tennessee Valley Authority in expediting the completion of the detailed soil survey of that area and in conducting research on the various soil types in order to determine their capabilities for agricultural use. Accurate detailed maps showing the location of the various individual soil types having particular possibilities for use under different types of management are essential in developing systems of agriculture offering security to the farm family and for the improvement of the land, prevention of erosion, and the protection of streams and reservoirs.

Similarly, the Bureau is cooperating with a great many States in order to secure the information essential to a solution of their land use problems. For example, in several of the Western States, such as California, Oregon, Utah, and Washington, information on soils is essential for planning the extension of certain special crops and for the proper planning or extension of irrigation in order to avoid areas subject to accumulation of alkali or those having excessive water requirements or other draw-backs.

The problems in each State, and even in each county, are more or less individualistic and require somewhat different data for their solution. This fact emphasizes the necessity of cooperation among Federal, State, and local people in order that a balanced point of view may be obtained. The soil maps are made in such a way as to indicate those physical differences in the land which determine or influence its capabilities for use. Usually an area has more than one problem; the soil map must carry the physical information pertinent to all of them. Thus, from the soil map, other relatively simple maps, showing only one characteristic, may be made by interpretation. For example, supplemental maps showing only erodibility, slope, lime requirement, drainage, or similar features can be made from the soil map. Others may be prepared showing relatively simple groups of soils according to their adaptability to alfalfa, tree fruits, or to other crops or groups of crops. Using the soil map as the base, others may be prepared showing the general suitability of the land for agricultural or other uses as a means for developing plans for rural zoning. All these relatively simple maps would be different from one another, although each one would be taken from the master soil map. In North Dakota, for example, soil maps are used as the basis for rating rural land for tax assessments.

REGIONAL INVESTIGATIONS

Since it is of the utmost importance that the nomenclature of soil types, their definitions, and classification be everywhere consistent, regional comparisons of soil types are essential to the general program. These activities are conducted by the supervisory scientists of the Bureau who are also responsible for the nomenclature used on the detailed soil maps. Special regional studies have been continued in the western portions of the country, where the present information is inadequate for the proper conduct of more detailed surveys.

PRODUCTIVITY RATING

Continued progress was made in the establishment of systematized methods for relating the results of experience and experiments to the individual soil types (and phases) in order that each type that is shown on the soil map may be given a definite rating according to its productivity and crop adaptability. One of the major objectives of this work is to report on the productivity of individual soil types as influenced by different systems of management. An increased number of the soil surveys being published currently contain tables showing these productivity ratings, and it is expected that this research will be pushed to the point where such tables will accompany all soil surveys as soon as the system is broadened and fully developed.

PREPARATION OF SOIL MAPS

After the soil maps have been drawn in the field and the necessary description of the soils and their capabilities for use prepared, the maps are redrawn for publication, and the reports, including soil descriptions, recommendations for their use, agricultural statistics, and similar matters, are printed. These reports and maps are generally published in county units, although occasionally the unit of publication is more or less than one county, such as a stream valley or a watershed. When completed, the reports and maps are made available to the public and to all the Government agencies having need for them.

PROGRESS

The progress of soil mapping is shown in tables 1 and 2, and a list of soil surveys published during the current year is included with the list of publications at the end of this report. It will be noted that over 14½ million acres were surveyed during the year. The reports were issued for 38 areas, covering 16,984,960 acres.

TABLE 1.—*Individual areas surveyed and mapped during the fiscal year ended June 30, 1938*

State or Territory	Area	Area surveyed	
		Square miles	*Acres*
Alabama	Elmore County	[1] 98	62,720
	Lee County	[1] 316	202,240
Arizona	Yuma-Desert area [2]	[1] 168	107,520
California	Kings County	[1] 907	580,480
	Tracy area	375	240,000
Colorado	Washington County	[1] 399	255,360
Florida	Alachua County	[1] 259	165,760
	Collier County	102	65,280
Georgia	Candler County	86	55,040
	Union County	250	160,000
Hawaii	Hawaiian Islands	[1] 1,000	640,000
Idaho	Blackfoot-Aberdeen area [3]	[1] 110	70,400
	Idaho Falls area	88	56,320
Indiana	Franklin County	87	55,680
	Fulton County	[1] 320	204,800
	Johnson County	[1] 281	179,840
	Morgan County	[1] 379	242,560
Iowa	Allamakee County	[1] 255	163,200
	Tama County	[1] 402	257,280
Kentucky	Marshall County	327	209,280
Maine	York County	[1] 362	231,680
Michigan	Midland County	348	222,720
	Newaygo County	[1] 166	106,240
Minnesota	Rock County	229	146,560
	Washington County	[1] 95	60,800
Mississippi	Alcorn County	41	26,240
	Prentiss County	95	60,800
Missouri	St. Charles County	22	14,080
Montana	Big Horn River Valley area	79	50,560
Nebraska	Cherry County	[1] 1,637	1,047,680
	Lancaster County	[1] 572	366,080
	Otoe County	[1] 197	126,080
New Hampshire	Cheshire County	[1] 328	209,920
	Coos County	[1] 745	476,800
	Hillsboro County	119	76,160
New York	Niagara County	[1] 149	95,360
	Seneca County	336	215,040
	Sullivan County	[1] 770	492,800
North Carolina	Jackson County	[1] 306	195,840
	Mitchell County	67	42,880
	Swain County	[1] 210	134,400
	Transylvania County	[1]210	134,400
	Warren County	[1] 165	105,600
Ohio	Tuscarawas County	[1] 108	69,120
Oklahoma	Choctaw County	[1] 107	68,480
	Creek County	[1] 201	128,640
	Noble County	153	97,920
	Okfuskee County	32	20,480
	Woods County	[1] 521	333,440
Oregon	Astoria area	79	50,560
	Baker area	[1] 91	58,240
Pennsylvania	Crawford County	[1] 350	224,000
	Fayette County	[1] 266	170,240
Rhode Island	Providence County	[1] 166	106,240
South Carolina	Charleston County	143	91,520
	Pickens County	[1] 38	24,320
Tennessee	Bedford County	[1] 289	184,960
	Cumberland County	[1] 417	266,880
	Rhea County	49	31,360
Texas	Dimmit County	[1] 638	408,320
	Fannin County	[1] 246	157,440
Utah	Beryl-Enterprise area	69	44,160
	Provo-Lehi area	[1] 122	78,080
Virginia	Mecklenburg County	65	41,600
	Princess Anne County	[1] 208	133,120
	Scott County	49	31,360
	Smyth County	[1] 246	157,440
	Tazewell County	[1] 424	271,360

[1] These figures do not include portions of these areas surveyed in preceding years.
[2] Previously reported as Yuma-Gila area, Ariz.
[3] Previously reported as Bingham County, Idaho.

TABLE 1.—*Individual areas surveyed and mapped during the fiscal year ended June 30, 1938*—Continued

State or Territory	Area	Area surveyed	
		Square miles	*Acres*
Washington	Clallam County	1,673	1,070,720
	King County	[1] 490	313,690
	Pierce County	531	339,840
	Skamania County	32	20,480
West Virginia	Greenbrier County	[1] 346	221,440
Wyoming	Campbell County	[1] 1,090	697,600
Total		22,696	14,525,440

[1] These figures do not include portions of these surveyed in preceding years.

TABLE 2.—*Areas surveyed and mapped in the several States during the fiscal year ended June 30, 1938, and the areas previously reported*

DETAILED

State or Territory	Work during 1938	Work previously reported	Total	
	Square miles	*Square miles*	*Square miles*	*Acres*
Alabama	414	60,502	60,916	38,986,240
Arizona	168	5,069	5,237	3,351,680
Arkansas		15,547	15,547	9,950,080
California	1,282	39,972	41,254	26,402,560
Colorado	399	6,733	7,132	4,564,480
Connecticut		1,704	1,704	1,090,560
Delaware		2,276	2,276	1,456,640
Florida	361	15,389	15,750	10,080,000
Georgia	336	36,680	37,016	23,690,240
Hawaii	1,000	2,668	3,668	2,347,520
Idaho	198	12,965	13,163	8,424,320
Illinois		6,770	6,770	4,332,800
Indiana	1,067	22,371	23,438	15,000,320
Iowa	657	52,204	52,861	33,831,040
Kansas		16,854	16,854	10,786,560
Kentucky	327	5,954	6,281	4,019,840
Louisiana		17,431	17,431	11,155,840
Maine	362	2,475	2,837	1,815,680
Maryland		13,959	13,959	8,933,760
Massachusetts		8,811	8,811	5,639,040
Michigan	514	33,267	33,781	21,619,840
Minnesota	324	13,020	13,344	8,540,160
Mississippi	136	31,168	31,304	20,034,560
Missouri	22	37,177	37,199	23,807,360
Montana	79	3,287	3,366	2,154,240
Nebraska	2,406	70,448	72,854	46,626,560
Nevada		652	652	417,280
New Hampshire	1,192	5,120	6,312	4,039,680
New Jersey		9,895	9,895	6,332,800
New Mexico		2,565	2,565	1,641,600
New York	1,255	37,993	39,248	25,118,720
North Carolina	958	49,743	50,701	32,448,640
North Dakota		23,049	23,049	14,751,360
Ohio	108	18,782	18,890	12,089,600
Oklahoma	1,014	26,339	27,353	17,505,920
Oregon	170	16,274	16,444	10,524,160
Pennsylvania	616	23,015	23,631	15,123,840
Puerto Rico		3,765	3,765	2,409,600
Rhode Island	166	1,921	2,087	1,335,680
South Carolina	181	27,254	27,435	17,558,400
South Dakota		8,286	8,286	5,303,040
Tennessee	755	13,764	14,519	9,292,160
Texas	884	67,425	68,309	43,717,760
Utah	191	3,215	3,406	2,179,840
Vermont		1,175	1,175	752,000
Virginia	992	16,535	17,527	11,217,280
Washington	2,726	13,394	16,120	10,316,800
West Virginia	346	24,335	24,681	15,795,840
Wisconsin		26,659	26,659	17,061,760
Wyoming	1,090	14,787	15,877	10,161,280
Total	22,696	970,643	993,339	635,736,960

TABLE 2.—*Areas surveyed and mapped in the several States during the fiscal year ended June 30, 1938, and the areas previously reported*—Continued

RECONNAISSANCE

State or Territory	Work during 1938	Work previously reported	Total	
	Square miles	*Square miles*	*Square miles*	*Acres*
Alaska		31,915	31,915	20,425,600
Arkansas-Missouri		58,000	58,000	37,120,000
California		32,135	32,135	20,566,400
Kansas		39,960	39,960	25,574,400
Michigan		1,322	1,322	846,080
Minnesota		12,744	12,744	8,156,160
Montana	65	54,878	54,943	35,163,520
Nebraska		53,064	53,064	33,960,960
North Dakota		39,240	39,240	25,113,600
Ohio		41,420	41,420	26,508,800
Pennsylvania		41,405	41,405	26,499,200
South Dakota		41,400	41,400	26,496,000
Texas		152,855	152,855	97,827,200
Vermont		9,124	9,124	5,839,360
Washington		18,409	18,409	11,781,760
Wisconsin		14,425	14,425	9,232,000
Total	65	642,296	642,361	411,111,040

SPECIAL WORK OF THE SOIL SURVEY

For the successful prosecution of many of the activities of the Federal Government and cooperating State agencies it has been necessary for scientists in the Soil Survey Division to interpret the available soil data in terms of the particular objective at hand. As the soil-survey data are basic for almost all kinds of agricultural activities, thousands of private individuals and organizations, as well as public agencies, seek the advice and assistance of soil scientists of the Bureau as to the location of soil types adaptable to various crops and how the various soil types may be managed. Requests of this kind have greatly increased in the last few years.

For many years scientists in the Soil Survey Division have called attention to the serious injury, through erosion, to soils when they are improperly used. The characteristics of the soil type determine its erodibility under different kinds of use and methods of management. The necessity for proper definition, classification, and correlation of the soil types is recognized as fundamental to soil conservation and land use adjustment programs. The Bureau has this responsibility through the Soil Survey Division. The soil maps serve as a basis for erosion surveys and erosion-control projects. In many instances where these maps have been unavailable, soil scientists of this Bureau have assisted in making special studies and maps for the use of Federal and State agencies. Scientists of the Bureau are assisting the Tennessee Valley Authority, Soil Conservation Service, and other agencies in making such studies and maps.

In addition to the attention given to the possibilities of land for irrigation in connection with the regular soil-survey projects, special reports have been prepared in regard to the suitability of land for irrigation in areas under the jurisdiction of other governmental agencies.

Work has been continued on the investigation of peat lands in cooperation with other Federal and State agencies, particularly from the point of view of the relationship of such soils to the conservation of land and prevention of floods and their utilization for wildlife. Special studies and reports have been made of peat areas in connection with the work of the Bureau of Biological Survey and the Bureau of Entomology and Plant Quarantine and other agencies having special problems in the utilization of these lands.

Special work of particular interest was the preparation of a series of land-classification maps of 96 representative counties having comparatively recent soil-survey maps and reports, for the Highway Planning Division of the Bureau of Public Roads. These maps were requested as a part of the data for planning and locating farm-to-market roads. The following classification, based on current productivity and land use, was shown: Excellent cropland, good cropland, fair cropland, poor cropland, pasture and grazing land, forest land, and waste land.

Special field mapping of soils in the commercial apple orchards of the limestone valley was carried on for the Farm Credit Administration in cooperation with other government and State agencies in order to provide adequate data for the determination of loan policies.

The services of an experienced fieldman were furnished for a period of several months to the Bureau of Agricultural Economics as an aid in developing land programs in the northern Great Plains.

YEARBOOK FOR 1938

In accordance with the Secretary's memorandum of January 27, 1937, whereby the Yearbook of Agriculture for 1938 was delegated to treat with departmental activities in soils, considerable time was spent by scientists of the Soil Survey Division in preparing papers on the various aspects of soil science and its development. Among the subjects discussed are the physical properties of soils, organic matter, processes and factors responsible for the formation of soil from parent material, principles of soil classification, zonal, intrazonal, and azonal soils, soil maps and their use. the soil requirements of economic plants, extent and nature of soil losses, and the need of coordinated research in soil survey, soil chemistry, and soil management. A special feature of the Yearbook is the inclusion of a map of the soil associations of the United States, including the insular possessions. Each area takes its name from the dominant soil series. An accompanying text briefly describes each area as to geographic setting, climate, vegetation, parent materials, soils, and land use.

INFORMATION AND PUBLICATIONS

The Bureau published 38 soil-survey bulletins, 7 technical bulletins, 1 circular, 1 miscellaneous publication, 2 farmers' bulletins, 4 revised bulletins, 3 articles in the Journal of Agricultural Research, 1 annual report, 22 mimeographed publications, and 188 articles in technical and trade journals. The Bureau also furnished information on various phases of its research through the press and radio services of the Department.

Fourteen patents were issued to scientists of the Bureau during the year.

The following lists show the publications and patents of the 10 research divisions of this Bureau:

LIST OF PUBLICATIONS

CARBOHYDRATE RESEARCH DIVISION

New sirup method success. By Henry G. Knight. South. Agr. 68 (1) : 8 and 19. 1938.

New method enables farmers to make better sirup. By Henry G. Knight. Farm Sec., Mobile Press Register, pp. 9 and 23. Jan. 30, 1938. Mobile, Ala.

The extraction of certain nonsugars of sugarcane during milling. By C. A. Fort and R. L. Holmes. Sugar Bull. 16 (4) : 3–4. 1937. (With Bur. Plant Indus.)

Relative inversion of sucrose in mill and windrowed cane of commercial and seedling varieties in Louisiana. By J. I. Lauritzen. C. A. Fort, and R. T. Balch. Sugar Bull. 16 (2) : 5–8. 1937. (With Bur. Plant Indus.)

Estimation of degree of souring in sugarcane juice. By C. A. Fort and J. I. Lauritzen. Indus. and Engin. Chem., Analyt. Ed. 10 : 251–253. 1938. (With Bur. Plant Indus.)

Preliminary studies on the composition of the whole cane of varieties Co. 281 and Co. 290. By C. A. Fort and R. L. Holmes. Sugar Bull. 16 (6) : 2–4. 1937. (With Bur. Plant. Indus.)

A preliminary study of the use of air agitation for graining and curing of Louisiana string sugars. By Emil K. Ventre. Sugar Bull. 15 (24) : 10 and 12. 1937.

Evaporator for research on sirup manufacture. By C. F. Walton, Jr., and E. K. Ventre. Internatl. Sugar Jour. 39 '497) : 430–431. 1937.

Recent developments in the production of sweet potato starch. By H. S. Paine. Potato World 6 (8) : 8–13. 1937.

Temperature and starch-sugar change in sweet potatoes. By E. F. Hopkins and J. K. Phillips. Sci. 86 : 523–525. 1937.

A simple gas thermoregulator. By R. M. Kingsbury. Indus. and Engin. Chem., Analyt. Ed. 9 : 333. 1937.

A new and rapid dehydration process for vegetables. By E. F. Hopkins. Sci. 87 : 71–72. 1938.

Hygroscopic properties of honey. By R. E. Lothrop. Gleanings Bee Cult. 65 (11) : 664–666. 1937.

Utilization of honey in commercial baking and in other industries. By R. E. Lothrop and L. H. Bailey. Amer. Bee Jour. 78 (2) : 54–57. 1938.

Recent progress in industrial utilization of honey. By C. A. Browne. Amer. Bee Jour. 57 (12) : 563–565 and 593. 1937.

The composition of expressed lumbang oil. By G. S. Jamieson and R. S. McKinney. Oil and Soap 14 (8) : 203–205. 1937.

A further study on the composition of American Tung oil with special reference to the linoleic acid content. By R. S. McKinney and G. S. Jamieson. Oil and Soap 15 (2) : 30–33. 1938.

The chemistry of the acyclic constituents of natural fats and oils. By G. S. Jamieson. (Abstract) Ann. Rev. Biochem. 7 : 77–99. 1938.

Distribution and variation with maturity of dissolved solids, sucrose and titratable acidity in the sorgo stalk. By Emil K. Ventre and S. Byall. Jour. Agr. Res. 55 : 553–562. 1937.

Farm production of sorgo sirup. By C. F. Walton, Jr., E. K. Ventre, and S. Byall. U. S. Dept. Agr. Farmers' Bull. 1791.

The effect of applications of common salt upon the yield and quality of sugar beets and upon the composition of the ash. By J. G. Lill, S. Byall, and L. A. Hurst. Jour. Amer. Soc. Agron. 30: 97–106. 1938. (With Mich. Agr. Expt. Sta. and Bur. Plant Indus.)

CHEMICAL ENGINEERING RESEARCH DIVISION

Rural losses $225,000,000 yearly. By D. J. Price. Volunteer Firemen 4 (12): 5. 1937.

Development in farm and rural community fire prevention. By D. J. Price. W. Va. Univ. Bull. Series 38 (6–IV): 30–34. 1937.

What have we learned from the New London, Tex., school explosion. (Kansas City, Mo.) By D. J. Price. Lessons from the New London, Tex., school explosion. (Oklahoma City, Okla.) BC&SMC—15. 1937. (Mimeographed); Lessons from the New London, Tex., school explosion of importance to firemen. Ann. Conv. Pa. State Firemen's Assoc. Proc. 58: 16–27. 1937; New London, Tex., school explosion findings. Weekly Underwriter 137 (19): 985–987. 1937; New London, Tex., schoolhouse explosion. Pa. State Alumni News, pp. 16–17. Sept. 1937; Explosion at consolidated school, New London, Tex., W. Va. Univ. Bull. Series 38 (6–IV): 16–26. 1937.

Urgent need for program on agricultural accident prevention. By D. J. Price. BC&SMC—16. 1937. (Mimeographed.)

Prevention and control of dust explosions in industrial plants. By D. J. Price and Hylton R. Brown. Quart. Natl. Fire Protect. Asso. 31 (1): 496–502. 1937.

Developments in farm and rural community fire prevention. By D. J. Price and Harry E. Roethe. Quart. Natl. Fire Protect. Assoc. 31 (1): 385–389. 1937.

Spontaneous heating and ignition of hay. By Harry E. Roethe. Agr. Engin. 18 (12): 547–550 and 554. 1937; Weekly Underwriter 138 (6): 351–353. 1938.

Safe use and storage of gasoline and kerosene on the farm. U. S. Dept. Agr. Farmers' Bull. 1678. (Revised 1938.) (Issued by Burs. Chem. and Soils, Agr. Engin., and Agr. Econ., and Natl. Fire Protect. Assoc.)

Fire-protective construction on the farm. U. S. Dept. Agr. Farmers' Bull. 1590. (Revised 1938.) (Issued By Burs. Chem. and Soils, Agr. Engin., and Agr. Econ., and Natl. Fire Protect. Assoc.)

Fire safeguards for the farm. U. S. Dept. Agr. Farmers' Bull. 1643. By V. N. Valgren, Harry E. Roethe, Wallace Ashby, and William H. Rowe. (Revised 1938.) (With Farm Credit Admin. and Burs. Agr. Engin. and Agr. Econ.)

Fires on farms. U. S. Dept. Agr. Leaflet 44. By Harry E. Roethe. (Revised 1938.)

Down on the farm. By H. E. Roethe. Safety Engin. 75 (1): 37–38; (2): 39. 1938.

The part dust plays in industrial plant fire hazards. By D. J. Price. Fire Engin. 90 9: 462–465. 1937.

Dust explosions during fire fighting. By D. J. Price. Fire Protect. 103 (4): 6. 1938.

CHEMICAL INVESTIGATIONS OF ALLERGENS IN AGRICULTURAL PRODUCTS

What's ahead in the cottonseed industry. By Henry G. Knight. Ann. Conv. Natl. Cottonseed Prod. Assoc. Proc. 42: 8–10. 1938.

FERTILIZER RESEARCH DIVISION

Report on phosphoric acid. A. Effect of the method of filtering on the determination of water-soluble P_2O_5. B. Variation in the citrate-insoluble P_2O_5 with the time interval between the water extraction and citrate digestion. By J. R. Adams and W. H. Ross. Jour. Assoc. Off. Agr. Chem. 21: 268–273. 1938.

Hygroscopicity of fertilizer mixtures. Effect of calcined phosphates. By C. W. Whittaker, J. R. Adams, and K. D. Jacob. Indus. and Engin. Chem. 29: 1144–1148. 1937.

Heat developed in the ammoniation of superphosphates with anhydrous ammonia. By J. O. Hardesty and W. H. Ross. Indus. and Engin. Chem. 29: 1283–1290. 1937.

Chemical reactions in fertilizer mixtures: Reactions of calcined phosphate with ammonium sulfate and superphosphate. By K. C. Beeson and K. D. Jacob. Indus. and Engin. Chem. 30: 304–308. 1938.

Chemical reactions in fertilizer mixtures. Decomposition of dolomite. By K. C. Beeson and W. H. Ross. Indus. and Engin. Chem. 29: 1176–1182. 1937.

Phosphate fertilizers by calcination process: Reversion of calcined phosphate at temperatures below 1400° C. By H. L. Marshall, D. S. Reynolds, K. D. Jacob, and T. H. Tremearne. Indus. and Engin. Chem. 29: 1294–1298. 1937.

Phosphate rock. By K. D Jacob. Mineral Indus. 45: 471–484. 1937.

Phosphate fertilizers by calcination process: Composition of defluorinated phosphate. By W. L. Hill, S. B. Hendricks, M. E. Jefferson, and D. S. Reynolds. Indus. and Engin. Chem. 29: 1299–1304. 1937.

Factors affecting the granulation of fertilizer mixtures. By J. O. Hardesty and W. H. Ross. Indus. and Engin. Chem. 30: 668–672. 1938.

Report on phosphoric acid. Citrate-insoluble phosphoric acid in ammoniated mixtures containing dolomite. By W. H. Ross, L. F. Rader, Jr., and K. C. Beeson. Jour. Assoc. Off. Agr. Chem. 21: 258–268. 1938.

The effect of various grades of fertilizers on the salt content of the soil solution. By L. M. White and W. H. Ross. Amer. Fert. 88 (5): 11. 1938.

The phosphate rock reserves of the United States. By K. D. Jacob. Com. Fert. Yearbook 57 (1): 28–43, 55, and 59. 1938.

The use of low temperature Van der Waals adsorption isotherms in determining the surface area of iron synthetic ammonia catalysts. By P. H. Emmett and S. Brunauer. Jour. Amer. Chem. Soc. 59: 1553–1564. 1937.

The measurement of surface areas of soils and soil colloids by the use of low temperature Van der Waals adsorption isotherms. By P. H. Emmett, S. Brunauer, and K. S. Love. Soil Sci. 45 (1): 57–65. 1938.

The use of low temperature Van der Waals adsorption isotherms in determining the surface areas of various adsorbents. By S. Brunauer and P. H. Emmett. Jour. Amer. Chem. Soc. 59: 2682–2689. 1937.

Adsorption of gases in multimolecular layers. By Stephen Brunauer, P. H. Emmett, and Edward Teller. Jour. Amer. Chem. Soc. 60: 309–319. 1938.

Review of "Atomic structure of minerals. By W. L. Bragg." By S. B. Hendricks. Rev. Sci. Instruments 8 (10): 368. 1937.

On the crystal structure of talc and pyrophyllite. By S. B. Hendricks. Ztschr. Kristallographie 99: 264–274. 1938.

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On the crystal structure of the clay minerals dickite, halloysite and hydrated halloysite. By S. B. Hendricks. Amer. Mineralogist 23 : 295–301. 1938.

The hydrogenation of ethylene by iron synthetic ammonia catalysts. By Rowland C. Hansford and P. H. Emmett. Jour. Amer. Chem. Soc. 60 : 1185–1190. 1938. (With George Wash. Univ.)

A spectrophotometric study of the equilibria in the gaseous system nitric oxide, nitrogen dioxide, and water. By E. H. Melvin and O. R. Wulf. Spectroscopy in Sci. and Indus. Proc. 5th Summer Conf. in Spectroscopy and its applications, pp. 110–113. 1938.

The absorption coefficient of nitrogen pentoxide and the visible absorption spectrum of NO_3. By E. J. Jones and O. R. Wulf. Jour. Chem. Phys. 5 : 873–877. 1937.

The atmospheric ozone equilibrium and its rate of maintenance. By Oliver R. Wulf. (Abstract) Jour. Wash. Acad. Sci. 28 : 32. 1938.

The solubility in liquid ammonia of hydrogen at 0° and of nitrogen at 0, 50, 75, 90, and 100° C. at pressures to 1,000 atmospheres. Critical phenomena of ammonia-nitrogen mixtures. By R. Wiebe and V. L. Gaddy. Jour. Amer. Chem. Soc. 59 : 1984–1987. 1937.

A glass sealing furnace. By J. R. Dilley. Rev. Sci. Instruments 8 (10) : 394–395. 1937.

Review of "Interpolation and allied tables. By L. J. Comrie." By W. E. Deming. Jour. Amer. Statis. Assoc. 32 : 587–588. 1937.

Chemistry—Response to the award of the Hillebrand prize for 1937. By S. B. Hendricks. Jour. Wash. Acad. Sci. 28 : 247–250. 1938.

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SOIL SURVEYS

Alabama

Dallas County.
Wilcox County.

Arizona

Upper Gila Valley area.

California

Barstow area.
Napa area.

Georgia

McDuffie County.

Indiana

Dubois County.
Pike County.

Iowa

Franklin County.

Kansas

Kingman County.

Michigan

Oceana County.
Saginaw County.

Mississippi

Marion County.

Nebraska

Boyd County.
Garfield County.
Gosper County.
Holt County.
Keya Paha County.
Loup County.

New York

Onondaga County.
Wyoming County.

North Carolina

Brunswick County.
Chatham County.
Jones County.
Pamlico County.
Surry County.

Ohio

Licking County.

Oklahoma

Carter County.
Greer County.
McIntosh County.
Mayes County.
Pittsburg County.
Woodward County.

Pennsylvania

Wayne County.

South Carolina

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Halifax County.
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U. S. GOVERNMENT PRINTING OFFICE: 1938

REPORT OF THE CHIEF OF THE COMMODITY EXCHANGE ADMINISTRATION, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
COMMODITY EXCHANGE ADMINISTRATION,
Washington, D. C., September 9, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith a report of the work of the Commodity Exchange Administration for the fiscal year ended June 30, 1938.

Sincerely yours,

J. W. T. DUVEL, *Chief.*

CONTENTS

	Page
Effectiveness of the Commodity Exchange Act	1
Functions of futures trading system	1
Trading in commodity futures:	
Volume of trading	2
Estimated dollar value of futures trading	3
Average daily volume of trading	4
Distribution by markets	4
Open contracts	5
Special accounts	6
Round-lot and job-lot trading	10
Deliveries	11
Transfer of cotton-delivery notices	11
Stocks of grain in Federal warehouses in Chicago	12
Principal activities:	
Designation of contract markets	12
Principal activities—Continued.	
Registration of futures commission merchants and floor brokers	13
Limitations on speculative grain futures transactions	14
Extension of delivery period for grains	14
Adoption by cotton exchanges of minimum margins	15
Segregation of customers' funds	15
Financial statements	15
Controlled commodity futures accounts	16
Review of market news and trade gossip	16
January 31, 1938, survey of open contracts	16
Investigation of September 1937 corn prices	17
Litigation	17
Controlled and uncontrolled commodities	18

EFFECTIVENESS OF THE COMMODITY EXCHANGE ACT

In recommending the passage of the act of June 15, 1936, amending and supplementing the Grain Futures Act and changing the name of the act as amended to the Commodity Exchange Act the Committee on Agriculture in its report to the House of Representatives stated that the fundamental purposes of the measure were: (1) To insure fair practice and honest dealing on the commodity exchanges; (2) to provide a measure of control over those forms of speculative activity which too often demoralize the markets to the injury of producers and consumers and the exchanges themselves; and (3) to restore the primary function of the exchanges which is to furnish a market for the commodities themselves. Substantial progress has been made toward their fulfillment.

FUNCTIONS OF FUTURES TRADING SYSTEM

The system of futures trading has come to be an integral part of the process of merchandising agricultural commodities. During the eighty-odd years since it originated in Chicago it has spread to all the commercially important markets. It has also extended from one commodity to another until there are now 29 agricultural commodities traded in for future delivery on American exchanges.

Commercial practices that have existed for a number of years unaided by subsidies or other artificial assistance and have, nevertheless, spread from one area to another, usually have sound economic justification. This is true of futures trading. It performs two important economic functions. The first is to focus at one central point all price-determining influences thereby creating maximum assurance that prices will at all times reflect fundamental supply and demand forces. Futures prices are widely and currently disseminated, aiding farmers, processors, and dealers. The second function of futures markets is to serve as a price-insuring medium for producers, processors, and dealers, a market in which they can place their hedges and protect themselves against loss through price fluctuations. Through the futures market the impact of seasonal marketing of these agricultural products is discounted and reduced.

TRADING IN COMMODITY FUTURES

VOLUME OF TRADING

GRAIN

As shown in table 1, trading in all grain futures on all contract markets in the United States totaled 12,386,000,000 bushels during the fiscal year, a decline of approximately 25 percent from the 16,577,000,000 total for 1937. Trading in wheat futures, which comprised 79 percent of all trading in grain futures, declined more than 16 percent, from 11,659,000,000 bushels in 1937 to 9,752,000,000 bushels in 1938. Trading in corn futures declined 33 percent, from 2,952,000,000 bushels in 1937 to 1,973,000,000 bushels in 1938. An even more precipitate decline took place in the volume of trading in oats futures, the 1938 figure being 418,000,000 bushels compared with 1,506,000,000 bushels for 1937, a decline of 72 percent. Trading in rye declined from 411,000,000 bushels in 1937 to 207,000,000 bushels in 1938, or 50 percent. A decline of 46 percent was recorded in barley, the 1938 total having been 22,000,000 bushels compared with 41,000,000 bushels during 1937. Trading in flaxseed futures increased from 8,000,000 to 14,000,000 bushels, or 75 percent.

TABLE 1.—*Annual volume of trading in wheat, corn, oats, rye, barley, flaxseed, and cotton futures, all contract markets combined, by fiscal years, from July 1, 1927 to June 30, 1938*

[Grains in millions of bushels, i. e., 000,000 omitted; Cotton in hundreds of bales, i. e., 00 omitted]

Year	Wheat	Corn	Oats	Rye	Barley	Flaxseed	Total grains	Cotton [1]
1927–28	11,201	7,818	1,239	513	44	59	20,904	1,696,220
1928–29	12,195	5,831	692	443	82	48	19,291	1,378,910
1929–30	19,607	3,668	946	644	97	38	25,000	1,058,610
1930–31	10,063	5,505	842	498	81	45	17,034	734,800
1931–32	10,148	2,639	382	342	31	24	13,566	672,940
1932–33	10,890	2,425	571	256	79	26	14,247	765,220
1933–34	10,093	3,314	1,457	495	164	18	15,541	802,850
1934–35	8,097	3,725	837	425	54	9	13,147	507,680
1935–36	8,644	1,403	655	258	30	17	11,007	374,700
1936–37	11,659	2,952	1,506	411	41	8	16,577	549,520
10-year average	11,230	3,928	916	428	70	29	16,631	854,145
1937–38	9,752	1,973	418	207	22	14	12,386	477,290

[1] Volume of trading for years, 1927–28 through 1936–37 does not include pass-outs.

COTTON

Although table 1 shows the volume of trading in cotton futures for the year 1937–38, the last 10 years, and the 10-year average, these figures are not strictly comparable inasmuch as the 1937–38 total of 47,729,000 bales includes a certain type of trade known as pass-outs which are not cleared and which were not included in figures for prior years. Inasmuch as pass-outs during recent months have approximated 18 percent of total transactions on the cotton exchanges, it is apparent that the decline in cotton futures transactions has been somewhat greater than in grain futures. Exclusive of estimated pass-outs the decline would have been 27 percent.

OTHER COMMODITIES

Although the total volume of trading for the full year 1937–38 in cotton, butter, eggs, potatoes, and millfeed futures is shown in table 2, the figures are unofficial. The rules and regulations of this Administration establishing reporting requirements did not become effective until October 1937 and official figures were therefore available for only a part of the year. Those for the remainder of the year were secured from the exchanges.

TABLE 2.—*Total volume of trading in cotton, butter, eggs, potatoes, and millfeed futures, by contract markets, fiscal year 1938*

Market	Cotton	Butter	Eggs	Potatoes	Millfeeds
	Bales	*Carlots*	*Carlots*	*Carlots*	*Tons*
New York Cotton Exchange	39,334,300				
New Orleans Cotton Exchange	8,108,850				
Chicago Board of Trade	285,650				
Chicago Mercantile Exchange		17,283	44,538	259	
New York Mercantile Exchange		4	3,254		
Kansas City Board of Trade					166,275
St. Louis Merchants' Exchange					280,675
Total	47,728,800	17,287	47,792	259	446,950

While there has been a drastic decline in the volume of futures trading, other economic activities have declined even more. The combined index of industrial production issued by the Federal Reserve Board, for example, declined from 115 in June 1937 to 77 in June 1938, or 33 percent. The dollar value of transactions on all registered securities exchanges in the United States declined from $28,052,500,834 in 1937 to $14,760,653,736 in 1938, a reduction of 47 percent. During this same period the index number of prices received by farmers for agricultural commodities declined from 124 to 92, or 25 percent.

ESTIMATED DOLLAR VALUE OF FUTURES TRADING

Although any estimate of the dollar value of futures trading can be only a rough approximation inasmuch as prices may vary on every contract that is executed, such an estimate reveals the relative importance of these transactions. As will be seen from table 3, the estimated value of futures trading during the year in the controlled commodities was $13,007,000,000, a decline of 48 percent from the $24,945,000,000 estimated total for 1937. This marked decrease was caused by the decline in prices as well as the decline in the actual volume of futures transactions.

TABLE 3.—*Volume and estimated value of futures trading in commodities under the Commodity Exchange Act, fiscal year 1938*

Commodity	Volume of futures trading	Estimated value of futures trading	
			Percent
Wheat—bushels	9,752,000,000	$8,969,360,000	68.9
Corn—do	1,973,000,000	1,361,370,000	10.5
Oats—do	418,000,000	121,220,000	.9
Rye—do	207,000,000	138,690,000	1.1
Barley—do	22,000,000	10,560,000	.1
Flaxseed—do	14,000,000	27,300,000	.2
Cotton—bales	47,729,000	2,104,849,000	16.2
Butter—carlots	17,287	99,244,667	.7
Eggs—do	47,792	118,041,824	.9
Potatoes—do	259	138,047	(1)
Millfeeds—tons	446,950	8,416,068	.1
Wool tops—pounds	58,500,000	48,500,000	.4
Total		13,007,689,606	100.0

[1] Less than 0.1 percent.

AVERAGE DAILY VOLUME OF TRADING

The average daily volume of trading in commodity futures on the principal contract markets during the year is shown in table 4. The largest amount of trading in a single day in wheat futures on the Chicago Board of Trade was 89,767,000 bushels, which was recorded on July 2, 1937, barely exceeding last year's maximum figure of 87,026,000 bushels, transacted on June 29, 1937, whereas the smallest amount, 6,443,000 bushels, recorded on February 26, 1938, was slightly below the previous year's minimum of 7,455,000 bushels, which occurred on October 24, 1936.

TABLE 4.—*Dates when largest and smallest day's trading occurred in commodity futures on specified markets, fiscal year 1938*

Market	Commodity	Unit	Average daily volume of trading	Largest amount of trading in single day			Smallest amount of trading in single day		
				Quantity			*Quantity*		
Chicago Board of Trade.	Wheat	Bushels	27,486,000	89,767,000	July	2, 1937	6,443,000	Feb.	26, 1938
	Corn	do	6,206,000	22,303,000	July	30, 1937	1,349,000	Jan.	24, 1938
	Oats	do	1,170,000	6,177,000	July	20, 1937	79,000	Mar.	1, 1938
	Rye	do	516,000	3,083,000	July	1, 1937	25,000	Do.	
Minneapolis Chamber of Commerce.	Wheat	do	1,448,000	4,169,000	Aug.	2, 1937	292,000	Dec.	24, 1937
Kansas City Board of Trade.	do	do	2,649,000	10,169,000	July	14, 1937	549,000	May	21, 1938
New York Cotton Exchange.	Cotton	Bales	131,100	401,900	Oct.	8, 1937	26,300	Apr.	30, 1938
New Orleans Cotton Exchange.	do	do	27,000	93,650	do		3,200	Do.	
Chicago Board of Trade.	do	do	950	4,900	Nov.	24, 1937	0	(1)	
Chicago Mercantile Exchange.	Butter	Carlots	59	229	Oct.	13, 1937	3	Mar.	31, 1938
	Eggs	do	153	1,008	Sept.	30, 1937	9	June	25, 1938
	Potatoes	do	1	20	Oct.	30, 1937	0	(1)	
St. Louis Merchants' Exchange.	Millfeeds	Tons	929	3,700	May	24, 1938	0	(1)	
Kansas City Board of Trade.	do	do	551	2,100	June	10, 1938	0	(1)	

[1] Occasional days of no trading.

DISTRIBUTION BY MARKETS

Eighty-six percent of all trading in grain futures took place on the Chicago Board of Trade, as shown in table 5. During the previous fiscal year 88.3 percent of all grain futures transactions was executed on that market. The Kansas City Board of Trade was second in volume with 7 percent of the total, compared with 5.7 percent last year. The Minneapolis Chamber of Commerce was third in importance, with a percentage of 4.8, a slight increase over the 4.4 percentage of last year.

TABLE 5.—*Total volume of trading in wheat, corn, oats, rye, barley, flaxseed, and all grain futures combined by contract markets, fiscal year 1938*

[In thousands of bushesl, i. e., 000 omitted]

Market	Wheat	Corn	Oats	Rye	Barley	Flaxseed	All grains	
							Quantity	*Percent*
Chicago Board of Trade	8,300,837	1,874,351	353,439	155,848	0	----------	10,684,475	86.3
Chicago Open Board	158,636	18,512	1,463	51	----------	----------	178,662	1.4
Kansas City	799,989	60,618	70	----------	----------	----------	860,677	7.0
Minneapolis	437,304	13,627	60,785	50,365	21,959	14,070	598,110	4.8
Duluth	37,712	----------	----------	48	0	248	38,008	.3
Milwaukee	10,771	5,707	1,633	709	0	----------	18,870	.2
St. Louis	2,295	50	44	----------	----------	----------	2,389	(1)
Seattle	3,729	----------	----------	----------	----------	----------	3,729	(1)
Portland	756	----------	----------	----------	----------	----------	756	(1)
San Francisco	----------	----------	----------	----------	120	----------	120	(1)
Los Angeles	----------	----------	----------	----------	168	----------	168	(1)
Total	9,752,029	1,972,865	417,484	207,021	22,247	14,318	12,385,964	----------
Chicago Board of Trade total to all contract markets—percent	85.12	95.01	84.66	75.28	----------	----------	86.26	----------

[1] Less than 0.01 percent.

Practically all trading in barley took place on the Minneapolis Chamber of Commerce while 98 percent of the flaxseed transactions was executed in that market.

Eighty-two percent of the volume of trading in cotton futures took place on the New York Cotton Exchange, 17 percent on the New Orleans market, and less than 1 percent on the Chicago Board of Trade.

OPEN CONTRACTS

Open contracts (the total of all futures contracts which have been entered into and not offset or fulfilled by delivery) are shown in tables 6, 7, and 8. The tendency is for open contracts to increase as the commercial stocks of grain and cotton increase and to decline as those stocks are reduced, thereby indicating the use of the futures market for hedging purposes. The small average daily open contracts in butter and potatoes, when considered in relation to the large stocks of those commodities, reveal the limited use of those futures markets for hedging purposes.

TABLE 6.—*Average daily open contracts in wheat, corn, oats, rye, barley, flaxseed and all grain futures combined by contract markets, fiscal year 1938*

[In thousands of bushels, i. e., 000 omitted]

Market	Wheat	Corn	Oats	Rye	Barley	Flaxseed	All grains	
							Quantity	*Percent*
Chicago Board of Trade	97,975	45,560	20,781	4,800	0		169,116	80.6
Chicago Open Board	580	178	68	2			828	.4
Kansas City	19,599	2,091	1				21,691	10.4
Minneapolis	9,007	297	3,077	1,652	728	935	15,696	7.5
Duluth	969			1	0	13	983	.5
Milwaukee	209	222	173	36	0		640	.3
St. Louis	261	4	1				266	.1
Seattle	292						292	.2
Portland	97						97	(1)
San Francisco					24		24	(1)
Los Angeles					100		100	(1)
Total	128,989	48,352	24,101	6,491	852	948	209,733	
Chicago Board of Trade total to all contract markets—percent	75.96	94.23	86.22	73.95			80.63	

[1] Less than 0.01 percent.

TABLE 7.—*Average daily open contracts in cotton, butter, eggs, potatoes, and millfeed futures, by contract markets, fiscal year 1938*

Market	Cotton [1]	Butter	Eggs	Potatoes	Millfeeds
	Bales	*Carlots*	*Carlots*	*Carlots*	*Tons*
New York Cotton Exchange	2,790,200				
New Orleans Cotton Exchange	432,700				
Chicago Board of Trade	8,600				
Chicago Mercantile Exchange		910	1,927	29	
New York Mercantile Exchange		1	98		
Kansas City Board of Trade					8,600
St. Louis Merchants' Exchange					20,300
Total	3,231,500	911	2,025	29	28,900

[1] Daily average for period Oct. 1, 1937, to June 30, 1938.

TABLE 8.—*Average daily open contracts in wheat, corn, oats, and rye futures on Chicago Board of Trade and cotton futures on New York Cotton Exchange, fiscal year 1938*

Month	Chicago Board of Trade				New York Cotton Exchange, cotton
	Wheat	Corn	Oats	Rye	
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*100 bales*
July	99,557	34,422	18,562	8,797	[1]
August	134,516	48,357	27,748	8,002	[1]
September	126,657	47,270	31,387	7,698	[1]
October	114,852	38,427	29,376	7,440	31,210
November	105,151	45,768	26,007	5,365	32,265
December	99,554	46,114	23,094	3,612	32,501
January	91,545	51,251	20,525	2,734	31,067
February	91,384	48,813	19,441	2,516	29,095
March	90,259	51,411	18,445	2,463	26,631
April	82,866	48,157	15,610	2,772	24,287
May	70,219	44,117	10,559	2,812	22,763
June	68,832	42,963	9,043	3,148	21,807
Average [2]	97,975	45,560	20,781	4,800	[3] 27,902

[1] Open contracts not available for July, August, and September 1937.
[2] Average computed from total open contracts for year, not from averages by months.
[3] Average daily for 9 months.

SPECIAL ACCOUNTS

Those who trade in futures range from the many who trade in very small amounts to the few who trade in large amounts. Both small and large traders are capable at times of influencing the course of futures prices. To observe the influence of the small traders it is necessary to lump together their purchases as well as their sales and their market positions since the size of their individual operations is too small to have any appreciable effect.

For the large traders this may not be the case. At times the operations of a single speculator are sufficiently large to have an appreciable, direct market effect. When such trading attracts a following of smaller traders its indirect effect gives it added market influence.

For these reasons the Commodity Exchange Administration requires direct daily reports from each of the larger market interests. These reports (referred to here as "special accounts") show the daily purchases and sales together with the market position of the trader at the close of each trading session classified by markets, by commodities, and by futures. They also show whether the trading consists of hedges, spreads or straddles, or open speculations. For grain a minimum of 200,000 bushels in any one future is used as a limit at or above which daily reports must be made. For cotton this limit is 5,000 bales in any one future.

These minimum reporting limits are not small amounts. A price change of 2½ cents on 200,000 bushels for grain or one-fifth of a cent per pound on 5,000 bales for cotton amounts to a gain or loss of $5,000. Hence the traders who report daily their trading and market positions are few in number compared to the thousands who operate in small amounts. The number of large accounts for wheat speculators, Chicago Board of Trade and for cotton speculators, New York Cotton Exchange is shown in tables 9 and 10. At no time during the past fiscal year did these speculators exceed 100 and usually they were much fewer in number.

TABLE 9.—*Wheat: Number of speculative accounts which had futures positions, either long or short, equal to or in excess of 200,000 bushels, Chicago Board of Trade, by months, July 1937 to June 1938*

Year and month	Distribution of accounts by size of position							
	Less than 500,000 bushels		500,000 to 995,000 bushels		1,000,000 to 1,995,000 bushels		2,000,000 bushels and over	
	Long	Short	Long	Short	Long	Short	Long	Short
1937	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
July	57	16	13	3	4	1	0	1
August	41	16	16	1	0	3	0	2
September	30	22	10	2	2	0	0	1
October	29	22	8	0	1	1	0	1
November	29	27	3	2	2	3	0	0
December	25	19	5	3	2	2	0	0
1938								
January	26	22	4	2	2	1	0	0
February	17	18	3	2	1	1	0	0
March	18	20	4	3	0	2	0	0
April	20	27	3	1	0	2	0	0
May	19	26	1	3	0	1	0	0
June	22	30	3	5	1	1	0	0

TABLE 10.—*Cotton: Number of speculative accounts which had futures positions, either long or short, equal to or in excess of 5,000 bales, New York Cotton Exchange by months, October 1937 to June 1938*

Year and month	Distribution of accounts by size of position							
	Less than 10,000 bales		10,000 to 19,900 bales		20,000 to 29,500 bales		30,000 bales and over	
	Long	Short	Long	Short	Long	Short	Long	Short
1937	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
October	9	4	0	1	0	0	0	0
November	7	4	1	0	0	0	0	0
December	7	5	0	0	1	0	1	0
1938								
January	5	3	0	0	1	0	1	0
February	6	2	0	0	1	0	0	0
March	4	2	2	0	0	0	0	0
April	7	0	1	1	0	0	0	0
May	9	0	1	0	0	0	0	0
June	8	2	2	0	0	0	0	0

While few in number their individual and combined market position is capable at times of reaching rather large proportions. Especially is this true for individual futures and for periods in the life of such futures when the total outstanding contracts are relatively small. Thus, one trader in the 1937 September corn future on the Chicago Board of Trade, near the end of the life of the future, controlled a long position of approximately 7,000,000 bushels which amounted to more than 80 percent of the total long contracts then open in that future. A few weeks earlier this trader had been long more than 9,000,000 bushels of September corn, at the same time being short in excess of 10,000,000 bushels of December corn which amounted to approximately 40 percent of the contracts then open in the December future. At such times individual accounts assume outstanding importance requiring close market supervision.

A broad picture of the market positions of these special accounts is presented in tables 11, 12, and 13 for wheat, corn, and cotton. Not all of the special accounts are included in these tables since the data relate only to the two leading exchanges. Daily average market positions by months during the fiscal year are shown for the

leading accounts and for the smaller accounts. The small-account positions represent simply the difference between the total open contracts (either long or short) and the special accounts.

TABLE 11.—*Wheat: Classification of average daily open commitments on the Chicago Board of Trade, all futures combined, fiscal year 1938* [1]

[Thousands of bushels, i. e., 000 omitted]

Month	Open contracts	Small accounts		Special accounts							
				Speculative		Hedging		Spreading		Total	
		Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1937											
July	99,557	69,393	30,705	16,333	18,753	9,163	45,431	4,668	4,668	30,164	68,852
August	134,516	104,806	38,006	8,685	3,172	8,445	73,327	12,580	20,011	29,710	96,510
September	126,657	95,638	31,585	7,033	2,372	10,476	73,325	13,510	19,375	31,019	95,072
October	114,852	81,534	28,426	5,774	1,890	13,129	66,040	14,415	18,496	33,318	86,426
November	105,151	72,068	29,074	4,682	3,721	12,529	56,743	15,872	15,613	33,083	76,077
December	99,554	70,321	28,516	6,722	5,306	10,079	53,022	12,432	12,710	29,233	71,038
1938											
January	91,545	68,181	28,763	5,664	2,638	8,981	49,785	8,719	10,359	23,364	62,782
February	91,384	68,134	30,970	4,259	2,555	9,791	46,849	9,200	11,010	23,250	60,414
March	90,259	68,079	33,370	3,330	3,740	8,841	41,340	10,009	11,809	22,180	56,889
April	82,866	58,752	34,951	2,574	3,505	12,224	32,451	9,316	11,959	24,114	47,915
May	70,219	47,739	32,482	1,416	3,997	12,228	25,254	8,836	8,486	22,480	37,737
June	68,832	44,305	38,094	2,431	4,953	14,934	19,976	7,162	5,809	24,527	30,738
Average [2]	97,975	70,770	32,131	5,781	4,779	10,890	48,562	10,534	12,503	27,205	65,844
Percent [2]	100.0	72.2	32.8	5.9	4.9	11.1	49.6	10.8	12.7		

[1] Preliminary data.
[2] Computed from total open commitments for year.

TABLE 12.—*Corn: Classification of average daily open commitments on the Chicago Board of Trade, all futures combined, fiscal year 1938* [1]

[Thousands of bushels, i. e., 000 omitted]

Month	Open contracts	Small accounts		Special accounts							
				Speculative		Hedging		Spreading		Total	
		Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1937											
July	34,422	20,318	25,424	10,680	4,109	2,370	3,834	1,054	1,055	14,104	8,998
August	48,357	29,971	29,872	3,663	3,571	7,577	7,721	7,146	7,193	18,386	18,485
September	47,270	28,870	26,561	2,490	3,746	10,797	11,580	5,113	5,383	18,400	20,709
October	38,427	24,345	22,534	2,558	3,374	6,677	7,583	4,847	4,936	14,082	15,893
November	45,768	23,380	21,491	4,199	3,377	13,308	15,930	4,881	4,970	22,388	24,277
December	46,114	21,003	13,724	6,227	2,206	14,873	26,001	4,011	4,183	25,111	32,390
1938											
January	51,251	21,194	13,392	11,663	2,099	15,020	32,336	3,374	3,424	30,057	37,859
February	48,813	21,686	12,992	8,781	1,104	15,242	31,590	3,104	3,127	27,127	35,821
March	51,411	22,504	15,028	7,912	1,436	18,093	31,976	2,902	2,971	28,907	36,383
April	48,157	23,087	13,633	6,948	2,546	15,350	29,106	2,772	2,872	25,070	34,524
May	44,117	21,950	11,198	5,700	2,614	13,270	26,840	3,197	3,465	22,167	32,919
June	42,963	16,839	11,655	5,029	1,849	18,502	26,780	2,593	2,679	26,124	31,308
Average [2]	45,560	22,925	18,171	6,315	2,678	12,574	20,859	3,746	3,852	22,635	27,389
Percent [2]	100.0	50.3	39.8	13.9	5.9	27.6	45.8	8.2	8.5		

[1] Preliminary data.
[2] Computed from total open commitments for year.

TABLE 13.—*Cotton: Classification of average daily open commitments on the New York Cotton Exchange, all futures combined, fiscal year 1938* [1]

[Hundreds of bales, i. e., 00 omitted]

Month	Open contracts	Small accounts		Special accounts							
				Speculative		Hedging		Straddling		Total	
		Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1937											
July	(2)										
August	(2)										
September	(2)										
October	31,210	25,212	8,930	212	41	4,055	20,812	1,731	1,427	5,998	22,280
November	32,265	26,771	8,182	168	7	4,062	23,352	1,264	724	5,494	24,083
December	32,501	26,672	7,629	669	77	4,233	24,271	927	524	5,829	24,872
1938											
January	31,067	26,568	8,379	498	26	3,531	22,412	470	250	4,499	22,688
February	29,095	25,037	7,891	285	15	3,303	20,829	470	360	4,058	21,204
March	26,631	23,347	7,904	230	6	2,668	18,235	386	486	3,284	18,727
April	24,287	21,120	7,710	282	116	2,453	15,782	432	679	3,167	16,577
May	22,763	18,989	8,326	270	5	2,366	13,483	1,138	949	3,774	14,437
June	21,807	17,700	8,595	263	4	2,148	11,831	1,696	1,377	4,107	13,212
Average [2]	27,902	23,439	8,175	322	33	3,191	18,936	950	758	4,463	19,727
Percent [3]	100.0	84.0	29.3	1.2	.1	11.4	67.9	3.4	2.7		

[1] Preliminary data.
[2] Data not available prior to Oct. 1, 1937.
[3] Computed from total open commitments for year.

The smaller accounts held the predominant position on the long side of the market, for cotton 84.0 percent of the total, for wheat 72.2 percent, and approximately one-half (50.3 percent) for corn. On the short side the large accounts were relatively more important, accounting for 70.7 percent of the total short positions in cotton, 67.2 percent in wheat and 60.2 percent in corn.

The special accounts were more important on the short side mainly because of the large hedging accounts. This fact is shown in the break-down of special account data into speculative, hedging, and spreading or straddling accounts. Thus for cotton almost the whole of the short special-account positions are shown to be hedges—67.9 percent out of 70.7 percent; for wheat 49.6 out of 67.2 percent; and for corn 45.8 out of 60.2 percent.

The dominance of short hedges over long hedges in all three commodities is also clearly shown—11.4 percent long against 67.9 percent short for cotton, 11.1 percent long against 49.6 percent short for wheat, and 27.6 percent long against 45.8 percent short for corn. Hedges are placed on both sides of the market since the hazard of loss due to unforeseen price change can affect those who have sold supplies of the actual commodity forward as well as those who hold such supplies unsold. However, the larger portion of hedges grow out of supplies held unsold. These roughly correspond to the commercial stocks of the commodity—that is, supplies in store at the larger centers.

With reference to the speculative special accounts, it will be observed that their combined position either long or short was not particularly large. For wheat long positions averaged 5.9 percent of all long positions and 4.9 percent of all short positions. For corn these percentages were 13.9 and 5.9. Cotton was considerably smaller (1.2 percent long and 0.1 percent short) due in part to the fact that the minimum reporting limit of 5,000 bales is somewhat higher in terms of value than either wheat or corn.

By netting the long and short positions of the speculative accounts each month, it is possible to know on which side of the market this group appeared during the course of the year. Thus for July 1937 the speculative accounts in wheat were 16,333,000 bushels long and 18,753,000 bushels short or net 2,420,000 short. These are, of course, average figures for the month during which time the actual net position of the group may have changed materially.

For wheat, this group of leading speculators moved from a net short position of 13 million bushels at the beginning of July 1937 to a net long position of 2¼

million by the end of July. This was increased to 8¾ million long by the end of September 1937. Their position continued long in gradually smaller amounts until the middle of March 1938. From this point on a short position was held amounting to 4½ million at the maximum point and 1½ million at the close of the fiscal year. For the year as a whole the net long positions of this group exceeded the net short positions in amount by approximately 1 million bushels; in point of time they were long 7½ months and short 4½ months. Their positions, however, were small compared with other years or with other groups during this year.

For corn the leading speculators started the year net long over 8 million bushels. This was entirely liquidated during July. During August, September, October, and November their combined net position was small, varying from one side of the market to the other several times. In December a net long position of over 10 million bushels was built up. This was gradually reduced to approximately 3 million bushels long by the end of the following June.

For cotton these positions were not known prior to October 1, 1937, when reporting requirements were first put into effect. At that time the large speculative accounts were net long and so continued throughout the remainder of the fiscal year.

A brief statement should be made regarding the spreading or stradd'ing positions shown in tables 11, 12, and 13. They represent positions of interests which follow a practice of buying one future and selling short an equal quantity of another future in the same commodity, in an attempt to profit from relative changes in price. The positions shown are not precisely in balance for the reason that they show in each case only one market and therefore only one-half of those spreads that are made between markets. Included in the figures shown are those between round lots and job lots. The latter are described more fully in the following section.

Persons in special-account status with respect to any contract market must report all positions including those in foreign markets. Table 14 shows the relative size of these foreign accounts during the year.

TABLE 14.—*Proportion of futures positions in wheat and cotton held in foreign markets, for all special accounts, fiscal year 1938* [1]

Commodity	Domestic markets		Foreign markets	
	Long	Short	Long	Short
	Percent	*Percent*	*Percent*	*Percent*
Wheat	79.3	86.4	20.7	13.6
Cotton	95.8	82.3	4.2	17.7

[1] It should be pointed out in connection with these figures that the percentages of foreign positions appear larger than they would were all positions used instead of the small total of special accounts. This is due to the fact that few small accounts operate in foreign markets.

ROUND-LOT AND JOB-LOT TRADING

It is well known that small speculators are ordinarily on the long side of the market, thus carrying a considerable proportion of the short hedges. The extent of their participation is partially revealed by table 15, which shows the amount and percentage of round-lot and job-lot trading on the Chicago Board of Trade during the year. Job lots are fractional parts of the official trading unit that is known as a round lot. The standard trading unit of the principal markets for each commodity is: Each of the grains, 5,000 bushels; butter, eggs, potatoes, 1 carlot; millfeeds, 100 tons; cotton, 100 bales; and wool tops, 5,000 pounds.

TABLE 15.—*Round-lot and job-lot trading on Chicago Board of Trade, fiscal year 1938*

[Thousands of bushels, i. e., 000 omitted]

Grain	Total volume of trading	Round-lot trading		Job-lot trading	
		Volume	Percent	Volume	Percent
Wheat	8,300,837	7,347,591	88.5	953,246	11.5
Corn	1,874,351	1,658,449	88.5	215,902	11.5
Oats	353,439	324,843	91.9	28,596	8.1
Rye	155,848	145,825	93.6	10,023	6.4
Total	10,684,475	9,476,708	88.7	1,207,767	11.3

Job-lot trading in wheat declined in volume from 972,857,000 bushels in 1937 to 953,246,000 bushels in 1938 but increased relatively to the total volume of trading from 9.58 percent in 1937 to 11.5 percent in 1938. Job-lot trading in corn declined from 368,260,000 bushels in 1937 to 215,902,000 bushels in 1938, showing a relative decrease from 13.02 percent in 1937 to 11.5 percent in 1938. Job-lot trading in oats and rye declined in actual volume but the percentage remained almost unchanged relative to the total volume of trading. Comparable figures relating to other commodities are not available.

DELIVERIES

As is customary the percentage of futures contracts settled by delivery during the fiscal year was exceedingly small. Of the total volume of trading in wheat futures on the Chicago Board of Trade, only 0.13 percent was settled by delivery, as shown in table 16. The percentage for the other grains and for cotton was less than 1 in each case. For butter, eggs, and potatoes the percentages ranged from 3.40 to 6.21.

TABLE 16.—*Volume of trading during life of all futures and total futures contracts settled by delivery for specified commodities upon contract markets, fiscal year 1938*

Market	Commodity	Unit	Total volume of trading during life of all futures maturing in fiscal year [1]	Futures contracts settled by delivery	Percent settled by delivery as related to total trading
Chicago Board of Trade	Wheat	Bushels	10,410,441,000	13,522,000	0.13
	Corn	do	2,477,929,000	13,574,000	.55
	Oats	do	618,009,000	2,244,000	.36
	Rye	do	285,784,000	2,266,000	.79
Minneapolis Chamber of Commerce	Barley	do	23,266,000	254,000	1.09
	Flaxseed	do	13,148,000	626,000	4.76
New York Cotton Exchange	Cotton	Bales	38,518,100	183,400	.48
New Orleans Cotton Exchange	do	do	8,222,450	67,650	.82
Chicago Mercantile Exchange	Butter	Carlots	15,488	527	3.40
	Eggs	do	43,544	1,484	3.41
	Potatoes	do	1,819	113	6.21
St. Louis Merchants' Exchange	Millfeeds	Tons	291,925	16,925	5.80
Kansas City Board of Trade	do	do	183,050	14,400	7.87

[1] These totals are not comparable with those of the volume of trading during the fiscal year inasmuch as trading began approximately 10 months before delivery month and consequently covers a longer period than the fiscal year.

Not only do most hedgers as well as speculators prefer not to receive delivery in settlement of futures contracts, but the vast proportion of futures trades remain open for very short periods. The closing out of open contracts in any given future takes place to a large extent before the beginning of the delivery month.

TRANSFER OF COTTON-DELIVERY NOTICES

One feature of futures marketing procedure in cotton that requires thorough investigation and study is the use of transferable notices in effecting deliveries. The seller of a futures contract has the right to issue a notice of delivery upon any designated notice day. Inasmuch as such notice is transferable, any buyer who receives it may, within the next 20 minutes, sell an equal quantity of the future on the floor of the exchange and pass the notice to the purchaser. Thus a notice of delivery of a given quantity may result in sales of many times that amount and exercise undue pressure on the price of the current month and such depressing effect may be intensified by the description of the cotton covered by the notice.

Since this Administration has had supervision over trading on the New York Cotton Exchange a plan has been worked out with the chairman of the warehouse and delivery committee whereby every member issuing a notice makes up at the same time a duplicate that goes to the final stopper of the notice, who adds thereto all endorsements shown on the original in the order in which made at the time of the delivery. The originals and duplicates are returned to the issuer, who checks them and deposits them with the local office of this Administration. The duplicates are then checked and retained and the originals sent to the

inspection bureau of the New York Cotton Exchange, which bureau returns them to the issuer.

Twenty-nine clearing members issued and twelve stopped all notices in the five active delivery months since supervision of this practice was started by this Administration. One firm accounted for approximately 33 percent and another for about 30 percent of the 1,520 notices issued. Those same two firms stopped 1,197 notices, 79 percent of all issued. The largest number of notices issued was on September 28, 1937, when 507 were issued for October 1937 delivery. It is apparent that this phase of cotton marketing should receive close supervision and investigation.

STOCKS OF GRAIN IN FEDERAL WAREHOUSES IN CHICAGO

On September 11, 1937, a call was issued to all Federal licensed warehouses in the Chicago area to report weekly thereafter the stocks of each grain in each warehouse grouped or classified as total deliverable grades, ungraded stocks, if any, and total stocks. This call was amended on February 18, 1938, to provide for reporting, by grade, the amount of each deliverable grade, the total of all nondeliverable grades and the total ungraded, if any.

These reports are consolidated into a summary report that is published weekly. It shows, for all Federal and State warehouses whose receipts are eligible for delivery on futures contracts, by grains, the total amount of each deliverable grade, the total of nondeliverable grades, and the total ungraded, if any. Data of this character concerning Federal licensed warehouses in Chicago had not previously been available and the compilation and publication of these weekly reports have proven highly useful to users of the grain futures market.

PRINCIPAL ACTIVITIES

DESIGNATION OF CONTRACT MARKETS

Under the provisions of the Commodity Exchange Act, all commodity exchanges desiring to conduct trading in futures must first be designated contract markets. The following list shows the 17 contract markets, as of June 30, together with the commodities in which futures trading is conducted by each:

Contract market	*Commodities in which futures trading is conducted*
Chicago Board of Trade	Grain,[1] cotton.
Chicago Mercantile Exchange	Butter, eggs, Irish potatoes.
Chicago Open Board of Trade	Grain.
Duluth Board of Trade	Flaxseed, grain.
Kansas City Board of Trade	Grain, millfeeds.
Los Angeles Grain Exchange	Barley.
Milwaukee Grain and Stock Exchange	Grain.
Minneapolis Chamber of Commerce	Flaxseed, grain.
New Orleans Cotton Exchange	Cotton.
New York Cotton Exchange	Do.
New York Mercantile Exchange	Butter, eggs.
New York Produce Exchange	Grain (no trading under act since 1932).
New York Wool Top Exchange [2]	Wool tops.
Portland Grain Exchange	Wheat.
St. Louis Merchants' Exchange	Grain, millfeeds.
San Francisco Grain Exchange	Barley.
Seattle Grain Exchange	Wheat.

[1] The term "grain" means those grains included in the Commodity Exchange Act, viz., wheat, corn, oats, rye, barley, and grain sorghums.

[2] The official name of this exchange is Wool Associates of the New York Cotton Exchange, Inc.

NEW YORK WOOL TOP EXCHANGE

By an amendment approved April 7, 1938, wool tops was added to the 13 commodities embraced by the Commodity Exchange Act. The Wool Associates of the New York Cotton Exchange (commonly known as the New York Wool Top Exchange), the only exchange in the United States conducting futures trading in wool tops, filed its application for designation as a contract market under the amended act on April 15. The exchange not being located at a terminal market for wool tops meeting the conditions set forth in section 5 (a) of the

statute, it was deemed necessary that it eliminate all but one of its 29 designated delivery points for wool tops under futures contracts, and, by formal regulation, confine deliveries to Boston. This action was taken in due course by the exchange, rules and regulations conforming to the requirements of section 5 of the act were adopted, and the applicant exchange being found to fulfill the statutory conditions precedent to designation, contract-market designation was issued by the Secretary of Agriculture on June 1, 1938.

SAN FRANCISCO GRAIN EXCHANGE

As a result of the removal of the San Francisco Chamber of Commerce from the building in which the Grain Trade Association of the San Francisco Chamber of Commerce, a contract market, was located that organization was dissolved on February 10, and a new exchange was organized to be known as the San Francisco Grain Exchange.

The newly organized San Francisco Grain Exchange filed application for designation as a contract market on February 14. Examination of its rules and regulations disclosed the need of various modifications to bring them into conformity with the statutory conditions precedent to designation. The required changes having been made by the exchange, it was duly designated by the Secretary of Agriculture as a contract market for wheat and barley on February 28, 1938.

REGISTRATION OF COMMISSION MERCHANTS AND FLOOR BROKERS

Eight hundred forty-three futures commission-merchant registrations and 631 floor-broker registrations were issued during the year. Of the futures commission-merchant registrations issued, 114 were for the period ended December 31, 1937, and 729 for the period ending December 31, 1938. Of the floor-broker registrations, 35 were for 1937 and 596 for 1938. Futures commission merchants also obtained 185 duplicate 1937 certificates and 1,759 duplicate 1938 certificates, or a total of 1,944 duplicates. Receipts for the year from registrations and the sale of duplicate certificates aggregated $18,628.

Information submitted by registrants incident to registration and revisions thereof currently filed have been tabulated and detailed records thereof maintained, which have proven of material aid in the administration of the act.

The following tabulation shows the location, by States, of the principal and branch offices of futures commission merchants registered under the act as of June 30, 1938:

	Number		Number
Alabama	16	New Jersey	39
Arizona	4	New Mexico	1
Arkansas	6	New York	400
California	72	North Carolina	22
Colorado	13	North Dakota	9
Connecticut	21	Ohio	59
Delaware	6	Oklahoma	18
District of Columbia	11	Oregon	11
Florida	19	Pennsylvania	94
Georgia	23	Rhode Island	12
Idaho	8	South Carolina	16
Illinois	244	South Dakota	9
Indiana	27	Tennessee	19
Iowa	46	Texas	54
Kansas	51	Utah	4
Kentucky	8	Vermont	2
Louisiana	35	Virginia	17
Maine	3	Washington	23
Maryland	16	West Virginia	8
Massachusetts	58	Wisconsin	32
Michigan	36		
Minnesota	129	Total	1,868
Mississippi	5	Hawaii	1
Missouri	110	Foreign	77
Montana	7		
Nebraska	43	Grand total	1,946
New Hampshire	2		

LIMITATIONS ON SPECULATIVE GRAIN FUTURES TRANSACTIONS

Although no definite limitations have been established on speculative trading in grain futures, proposed limits were announced by the Secretary of Agriculture on June 13, 1938. Public hearings on this subject had been held previously. Trading limits are not to become effective until they are promulgated by the Commodity Exchange Commission, consisting of the Secretary of Agriculture, the Secretary of Commerce, and the Attorney General.

The proposed order provides generally as follows:

A 2,000,000-bushel limit on net long or net short positions in all futures combined, or in any one future, of any one grain on any one contract market except during the delivery month when the limit will be 1,000,000 bushels. Spread positions between markets or between futures of the same grain are to be permitted up to 3,000,000 bushels, subject to the 1,000,000-bushel limit in a current delivery month which may not be exceeded under any conditions. Processors or manufacturers, upon a proper showing to the Secretary of Agriculture and upon approval by him in writing, may hold a long position in all futures and all contract markets combined equal to their reasonably anticipated requirements of cash grain for a period not exceeding 6 months in the future, provided such position is liquidated gradually as the cash grain is obtained.

A daily trading limit of 2,000,000 bushels in all futures combined or in any one future of any grain on any one contract market with a limit of 1,000,000 bushels in any current delivery month. As with the net positions, daily purchases or sales of 3,000,000 bushels representing spreads or the closing of spreads in the same grain between markets or between futures are permissible, except in a delivery month when the limit is 1,000,000 bushels.

A person whose net position, in any one future and in all futures combined on any one contract market, does not change more than 200,000 bushels during any business day may make purchases or sales totaling 3,000,000 bushels, except during the delivery month when the 1,000,000-bushel limit may not be exceeded.

These limitations were proposed in accordance with section 4a (1) of the Commodity Exchange Act and may of course be modified by the Commodity Exchange Commission before being fixed.

The purpose of such limitations is to eliminate drastic price changes brought about by the operations of large speculators. Too rigid limitations would, however, probably bring about the very conditions desired to be remedied for they would restrict speculation within such narrow limits as to accentuate price changes. Moreover, unreasonably low limitations might dislocate the machinery of the futures market to such an extent as to jeopardize its entire value for hedging purposes. It is therefore of the utmost importance that limitations should be established only after the most thorough investigation and when every aspect of the effects of such limitations has been contemplated.

The law also contemplates that limitations upon speculative transactions be promulgated for cotton, butter, eggs, potatoes, millfeeds, and wool tops. Basic material upon which such limitations may be established is being compiled and analyzed.

EXTENSION OF DELIVERY PERIOD FOR GRAINS

An inadequate supply of a commodity is one of the most common defects in conditions of delivery. Squeezes occur when the deliverable supply is relatively small and are accompanied by unusual price instability which increases toward the end of the delivery month. Squeezes are undesirable in that they make an artificial, not a real, market price, reduce the hedging value of a market, and draw supplies away from the normal channels of trade.

Heretofore the rules of the principal contract markets for grain have allowed 3 days during which contracts for the future delivery of grain may be settled by delivery of the actual cash grain after trading has ceased in any given delivery month. Recognizing that 3 days is a rather short time to get grain from the country into the larger terminal markets, a public hearing was held in Chicago to determine whether this delivery period should not be increased. As a result of that hearing an order was issued by the Secretary of Agriculture on February 17, 1938, requiring a period of 7 business days during which contracts for the future delivery of wheat, corn, oats, rye, barley, or flaxseed may be settled by delivery of the actual cash grain after trading has ceased in any given delivery month. All contract markets on which trading in grain or flaxseed was being conducted had taken formal action to make the order effective prior to the close of the year just ended.

By providing for a delivery period of 7 business days after trading has ceased those having a long position will know in advance that grain can be brought into the market from a large surrounding area and such knowledge will tend to prevent situations likely to result in squeezes or corners.

ADOPTION BY COTTON EXCHANGES OF MINIMUM MARGINS

The Commodity Exchange Act requires the segregation and separate handling of customers' margin moneys. It does not, however, prescribe what rates of margin shall be required nor does it give the Government authority to fix margin requirements. When the 1936 amendments were being discussed by the committees of Congress, the question of uniform margin requirements was considered but no provisions governing margins were included in the bill. In this connection it may be noted that under the National Recovery Administration Grain Exchange Code, the grain exchanges in 1934 had adopted uniform margin requirements applying to grain trades. With some modifications, these requirements have been continued voluntarily as sound business practice. The cotton exchanges, however, had no minimum margin requirements.

In the fall of 1937, the Commodity Exchange Administration took up informally with the cotton exchanges the question of minimum margin requirements applying to speculative trades. It was pointed out that while the Commodity Exchange Act contained no authority to require the adoption of minimum margin rules, such rules had been found desirable by other exchanges; that such rules tended to insure fair competition between commission firms and would tend to protect customers who, in the absence of substantial margin requirements, might be inclined to take a larger position in the market than their means would justify. It was suggested that such a rule would operate to protect individual commission firms as well as the market as a whole from the dangers of overextension of credit.

The New York Cotton Exchange, the New Orleans Cotton Exchange, and the Chicago Board of Trade gave ready ear to these suggestions and in due course adopted margin rules applying to speculative trades to become effective January 1, 1938. In general, these rules prescribe that initial margins on all speculative accounts equal to not less than those fixed for clearing members shall be required of all customers. The adoption of these rules was accepted in good spirit by the cotton trade as a whole and thus far, at least, they appear to be working satisfactorily.

SEGREGATION OF CUSTOMERS' FUNDS

No provision of the Commodity Exchange Act has been of greater interest or involved more administrative complications than section 4d (2) which provides for the segregation of customers' funds. The act provides that futures commission merchants shall "treat and deal with all money, securities, and property received by such person to margin, guarantee, or secure the trades or contracts of any customer of such person, or accruing to such customer as the result of such trades or contracts, as belonging to such customer. Such money, securities, and property shall be separately accounted for and shall not be commingled with the funds of such commission merchant or be used to margin, or guarantee the trades or contracts, or to secure or extend the credit, of any customer or person other than the one for whom the same are held."

In an effort to see that this provision of the law was complied with detailed examinations of the books and records of futures commission merchants were made by the accountants of this Administration. The total number of examinations completed between September 1, 1937, and August 31, 1938, was 654, which consisted of 632 original audits and 22 reexaminations. These examinations revealed that over 100 firms were undersegregated in excess of $750,000.

Other deviations discovered during these segregation audits were: (1) Failure to secure proper waivers from depositaries; (2) improper handling of customers' funds; (3) commingling of customers' funds with those of the firm; (4) carrying firm and customers' trades, and regulated and nonregulated trades together; and (5) improper or incomplete accounting.

All deviations noted by the accountants were promptly corrected with the exception of those cases upon which formal action was recommended. The majority of deviations were the result of misunderstanding and were easily corrected. Nevertheless it may not be inappropriate to say that several hundred thousand dollars have been saved the public by the strict enforcement of these segregation requirements.

FINANCIAL STATEMENTS

To supplement this work of assuring proper segregation of customers' funds the regulations were amended in November 1937 to require that every application for registration as futures commission merchant shall be accompanied by a statement of the financial condition of the applicant as of a date not more than 6 months prior to the date of filing application. The financial statements received

in connection with registration for 1938 were examined upon receipt and those firms that were not in a sound financial condition were given special attention.

CONTROLLED COMMODITY FUTURES ACCOUNTS

The Commodity Exchange Administration received a considerable number of complaints during the year concerning commodity accounts over which persons other than the owners exercise control. A general investigation has therefore been made of the extent and nature of the use of such controlled accounts during 1937. The findings of this investigation will be set forth fully in a report being prepared for publication.

A large majority of the persons who held authorizations to trade were relatives, friends, or business associates of the owners of the accounts. In such cases the use of controlled accounts did not adversely affect the public interest. There were, however, approximately 600 accounts controlled by professional commodity counselors, who solicit the management of commodity accounts among the general public and receive remuneration for directing trading for the account. It is primarily this type of controlled account that has given rise to complaint. In general it was found that commodity counselors frequently obtained accounts on the basis of misleading statements and misrepresentations of fact; that many such accounts were operated in a manner that probably misled the owners and may have impeded the price determining functions of commodity exchanges; and that the overwhelming majority of these accounts were unprofitable.

A conference of officials of the leading commodity exchanges and of the Department was held in Washington on August 1 for the purpose of considering methods of preventing so-called commodity counselors from defrauding the public through promises of extraordinary profits from dealings on the commodity exchanges. Among various suggestions which were made at this conference three specific proposals were recommended looking toward the correction of these conditions. They were: (1) That commission merchants be required to send to the owners of accounts controlled through power of attorney a monthly statement of the account showing not only the open positions but the profits or losses which would result if open positions were closed at the market; (2) that commission houses be required to "make up" all trades for accounts controlled through power of attorney thereby preventing those houses from holding open opposite positions in the same future in the same market; (3) that commission houses require that orders received from commodity counselors designate the account at the time the order is given so that there may be no allocating of trades to various accounts after orders have been executed. These proposals are now before the governing bodies of the several commodity exchanges for consideration and it is the hope of this Administration that prompt action will be taken upon them.

REVIEW OF MARKET NEWS AND TRADE GOSSIP

Each field office as well as the staff at headquarters in Washington gave careful attention to information contained in market letters issued by brokerage houses. While it is impossible to review all news letters and other informational services which are made available to the public, a large number of them are scrutinized. Information of questionable accuracy or of a misleading character is examined to determine the effect it has on the market and the motive behind its release if it is found to be inaccurate.

Twice during the year every registered futures commission merchant was directed to submit a copy of every statement, news letter, or other item issued on specified days. These samples were reviewed to ascertain the type of material being issued to the public.

JANUARY 31, 1938, SURVEY OF OPEN CONTRACTS

The Administration is undertaking, and has made considerable progress on, a cross-section analysis as of January 31, 1938, of the open contracts in all commodities covered by the law. This work, when completed, will give figures on the number of traders in the market on that date, the size of their holdings, their class—that is, whether speculative or hedging—their geographical location, and a considerable amount of other miscellaneous data.

A study of this type that was confined to wheat and corn accounts on the Chicago Board of Trade as of September 29, 1934, was found to be particularly helpful in dispelling the mystery as to who uses the futures markets and in what ways they are used. The present project should be more valuable in that it includes all grains as well as cotton, butter, eggs, potatoes, flaxseed, and millfeeds on all contract markets.

Such cross-section analyses give definite answers to many questions that have long been the subject of conjecture. Principal among these is the question, how much of the trading in commodity futures is for hedging purposes and how much is speculative? It was found with regard to wheat and corn in 1934 that roughly 80 percent of the short contracts were hedging and 20 percent speculative, while on the long side of the market an approximately opposite condition existed, 75 percent of the long contracts being speculative and 25 percent hedging. Whether this condition still exists in grain and whether it also applies to cotton and other commodities will be determined by the study now in process. Such facts as these will aid in evaluating the service rendered by the futures markets in the distribution of agricultural commodities.

Another very important objective in this work will be to ascertain whether any persons have divided their accounts among a number of commission merchants for the purpose of evading the reporting requirements of the Commodity Exchange Administration. In a somewhat similar study made as of June 30, 1931, it was found that one large trader had split his trading among 34 accounts carried under various names on the books of 8 commission merchants, many of these accounts being maintained for long periods at exactly 495,000 bushels which was one trading unit below the 500,000-bushel reporting requirement then in effect. Only by a complete cross-section analysis can such evasions of the law be detected.

The magnitude of this project is suggested by the fact that the work requires obtaining information from approximately 650 futures commission merchants and the analysis of 25,000 to 30,000 individual traders' accounts.

INVESTIGATION OF SEPTEMBER 1937 CORN PRICES

The situation that developed toward the end of the life of the 1937 September corn future on the Chicago Board of Trade made necessary a careful study of trading in September corn and of the general conditions in the corn market at that time. Because of the importance of the problems raised by this situation an intensive study was made of trading and prices for the months of July, August, and September and a special study was made of the interests in the market during the few days preceding September 24, when trading in the September future was discontinued at the order of the board of directors of the Chicago Board of Trade.

Previously the business-conduct committee of the Chicago Board of Trade had called upon the Cargill Grain Co., of Illinois, a subsidiary of Cargill, Inc., one of the largest cash grain firms in the United States, to liquidate a part of its long position in September corn. After trial and findings by the directors of the Chicago Board of Trade that the Cargill interests had violated certain board rules by attempting to manipulate corn prices and corner the market that company was expelled from membership representation on the Chicago Board of Trade. Cargill, Inc., on February 10, 1938, filed a complaint with the Commodity Exchange Commission charging the Chicago Board of Trade with having violated the Commodity Exchange Act in 1936 and again in 1937.

Oral argument on the motion of the Chicago Board of Trade to dismiss the Cargill complaint was heard by the Commission on May 26. The case was pending at the close of the year.

LITIGATION

The first criminal action to be brought under the provisions of the Commodity Exchange Act was against Burke & Co., of Sioux Falls, S. Dak., and Stephen A. Burke and Hugh S. Gamble, the two principal officers of the company. This corporation, prior to its liquidation, was engaged in the grain and stock brokerage business. Burke and Gamble were charged with misusing and permitting the misuse of grain customers' funds which resulted in a shortage of approximately $60,000. The corporation was also charged with having operated during part of the year 1938 without being properly registered with the Commodity Exchange Administration.

When arraigned in the United States Court for the District of South Dakota, both were found guilty.

On August 17, 1938, a hearing was held in Washington, D. C., before a referee appointed by the Secretary of Agriculture on a complaint requiring respondents, Gamble and Burke, to show cause why an order should not be made directing all contract markets to refuse them all trading privileges until further notice by the Secretary of Agriculture. The respondents failed to appear either in person or by attorney. The Secretary of Agriculture found that the charges were sus-

tained and the respondents accordingly were denied trading privileges on all contract markets.

CONTROLLED AND UNCONTROLLED COMMODITIES

At present 14 agricultural commodities are under the supervision of the Commodity Exchange Administration: Wheat, cotton, rice, corn, oats, rye, barley, flaxseed, grain sorghums, millfeeds, butter, eggs, potatoes, and wool tops. Wool tops was added by the act approved April 7, 1938 (52 Stat. 205). There are, however, 15 additional agricultural commodities traded in for future delivery in the United States which do not come within the purview of this Administration. They are: Cheese, cocoa, coffee, cottonseed meal, cottonseed oil, frozen eggs, hides, lard, molasses, peanuts, pepper, provisions (ribs and bellies), soybeans, sugar, and tallow.

The dollar value of trading in the 15 uncontrolled commodities is not nearly so large as that of the 14 controlled commodities. Trading in some of the uncontrolled commodities, however, is of vital importance to producers. Complaints are received from time to time involving uncontrolled commodities, indicating a rather widespread impression among traders that all agricultural commodities are subject to the provisions of the Commodity Exchange Act. No detailed information is available regarding the character or the use made of futures trading in the uncontrolled commodities.

U. S. GOVERNMENT PRINTING OFFICE: 1938

REPORT OF THE CHIEF OF THE BUREAU OF DAIRY INDUSTRY, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF DAIRY INDUSTRY,
Washington, D. C., September 1, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith a report of the work of the Bureau of Dairy Industry for the fiscal year ended June 30, 1938.

Sincerely yours,

O. E. REED, *Chief.*

CONTENTS

	Page
Introduction	1
Division of Dairy Herd-Improvement Investigations	3
Progress of association work	3
Proved-sire work	4
Identification and production record project	5
Cooperative bull associations	5
Dairy-farm records	6
Breeding, feeding, and management investigations	6
The experimental breeding herds at Beltsville, Md	6
Relation of conformation and anatomy to producing capacity	8
Feeding and management investigations at Beltsville, Md	10
Work at the field experiment stations	13
Division of Nutrition and Physiology	19
Carotene required for production of normal calves	19
Carrots as supplement to poor-quality hay	20
Minerals in cattle feeding	20
Raising calves on skim milk and poor-quality hay	20
The carotene (vitamin A) content of roughages	21
Relation of roughages to muscular dystrophy	22
Errors in determining the vitamin A value of butterfat	22
The composition of fats	23
Nutritional tests with small animals	24
Physiology of reproduction and milk secretion	24
Division of Dairy Research Laboratories	25
Chemistry and bacteriology of milk	25
Butter and byproducts	27
Ice cream	28
Cheese	28
Introducing new methods and products	30
Division of Market-Milk Investigations	31
Dairy sanitation investigations	31
Milk-plant management studies	31
Milk-quality-improvement investigations	33
Editorial and information work	35
Publications	35

INTRODUCTION

Both the economic welfare of the dairy farmers and the nutritional welfare of the people of the United States would be enhanced by a greater per-capita consumption of milk and other dairy products. The farmers are now producing more milk than they can sell at a satisfactory price; and the people are not consuming as much as they need, nor as much as they would if dairy prices were lower or consumer incomes were higher.

No doubt dairy prices are too low for profit on many milk-producing farms, particularly on the inefficient ones; but higher prices would tend to stimulate greater production throughout the country and to reduce consumer demand still further, thus creating even larger surpluses of dairy products.

In its research work over many years, the Bureau of Dairy Industry has sought to develop information that would enable both the dairy farmers and

the dairy processors to operate more efficiently and therefore to market their products profitably at lower price levels.

Nearly 40 percent of the milk produced in the United States goes to factories making butter or cheese, and this milk brings the farmers a much lower return than that used as fluid milk. About two-thirds of the constituents of this milk remain in the skim milk, buttermilk, and whey, and unless these factory byproducts are returned to the farm for livestock feeding or are utilized profitably at the factory, their valuable constituents are lost to the dairy industry. In recent years, the tendency of farmers to deliver whole milk instead of cream to the creamery has increased markedly, with the result that larger and larger quantities of skim milk must be disposed of by the creamery operator; and the disposal of whey has long been a source of annoyance and expense to the cheese maker. Obviously, if the dairy manufacturer can turn these byproducts into profit instead of loss he will be in position not only to operate more economically but to pay the farmer a price based on the value of the whole milk.

The fundamental research work of the Bureau scientists, some of which was done long ago, has contributed much useful information concerning ways to utilize skim milk, buttermilk, and whey. Bakers have been using large quantities of skim-milk powder for a number of years, and recently the Bureau's studies have enabled the processors to package skim-milk powder in small consumer-size units for home cooking.

Of the nearly 46 billion pounds of skim milk available for processing annually, about 38 billion is used as livestock feed, less than 7 billion is used for human food, and about 1 billion for making casein. Casein has many uses in the plastic arts, but most of the 35 million pounds made in this country is used by the paper-coating industry. With the announcement a few years ago that casein was being used in Italy to make a woollike fiber, the Bureau scientists started work to unravel the secret process. They have now applied for public-service patents for making casein fiber. No commercial production has yet begun in the United States, but it is estimated that Italy will produce 20 million pounds in 1938. Whether or not skim milk would be more profitable if made into fiber than if used as livestock feed depends on economic conditions.

One commercial plant is now using the method developed by the Bureau to make lactic acid, by fermenting the milk sugar of the whey from casein manufacture. This plant has found a market for all its lactic acid, but more would be made if new uses were found. Recently the Bureau has found it possible to make a resin from lactic acid, which promises to be useful in making varnishes and lacquers that are resistant to alcohol and water and that adhere to metals. Work is now under way also to devise a method of converting lactic acid into acrylic acid for use in making plastic glass.

Another notable achievement in the utilization of casein whey is the Bureau's new process for recovering the milk sugar somewhat more cheaply than formerly. This reduction in cost is made possible by the value of the two byproducts of the process, the soluble albumin and a residue rich in flavins. Soluble albumin is useful in infant foods and the flavin product is valuable because of the demand for concentrated forms of this compound by feed manufacturers.

Laboratory experiments have demonstrated the possibility of using large quantities of sweet whey in soups, fruit whips, and candies. A process has been perfected by which the smaller cheese factories can concentrate and preserve whey for sale to food manufacturers and confectioners.

The farmer's opportunity for greater efficiency in milk production lies largely in developing higher-producing herds through breeding and in the use of more and better roughage crops to reduce feeding costs. The Bureau now has completed 20 years of breeding investigations and the results indicate that the surest and quickest way for the average farmer to develop a herd of cows with inherently high average producing ability is through the use of a series of sires of known transmitting ability, or sons of such sires. A series of five proved sires in the Bureau's experimental herd of Holstein-Friesians has increased the inherent producing ability of the herd by 52 pounds of butterfat per cow per year, or from an average of 678 to 730 pounds. Eight proved sires in the Jersey herd are given credit for the average increase of 40 pounds, or from 634 to 674 pounds. These increases have been brought about entirely through breeding; that is, without the benefit of culling or of improving the feeding and management conditions throughout the 20 years.

An unexplained outbreak of bovine tuberculosis occurred again this year in the experimental dairy herds at Beltsville, Md., interfering seriously with the long-time breeding projects and also with the nutritional studies. Quarantine barns have been erected near the animal-disease station of the Bureau of Animal Industry to house some of the affected animals until they calve and complete their production records.

In 1936, two yearling bulls and one 2-year-old heifer of the South Devon breed were imported from England for use in experimental breeding studies. One of the bulls has been loaned to a cooperator; and the cow, having produced a heifer calf recently, is now making her first production record. The herd of Red Danish cattle now numbers 28 females and 17 males. Sixteen of the twenty imported females are left and two of those born here are now in milk. Eight male and six female calves were born during the year.

The Bureau's appropriation for the fiscal year 1939 provides for the establishment of a dairy-research project at the Coastal Plain Experiment Station, Willard, N. C., in cooperation with the North Carolina Department of Agriculture and the North Carolina Agricultural Experiment Station. The project will include breeding investigations, but the work will be directed mainly toward the discovery of the most profitable dairy feeding and management practices for the region.

Regulatory work involving inspection of process or renovated-butter factories was maintained throughout the year, in cooperation with other branches of the Federal Government. Marked improvement in equipment, machinery, and quality of the product was noted. For the first time in 5 years there was a decline in the amount of renovated butter manufactured by the qualified factories, the total being 2,476,599 pounds, or 9.5 percent less than in 1937. One of the five factories operating at the beginning of the year discontinued work, but another factory qualified so there are still five factories making this product.

During the year, Ernest Kelly, who has had charge of the Bureau's investigational work in market-milk problems since 1912, was named Assistant Chief of the Bureau. He will assist in planning and coordinating the Bureau's research work and in determining its policies. He continues also to serve as Chief of the Division of Market-Milk Investigations.

DIVISION OF DAIRY HERD-IMPROVEMENT INVESTIGATIONS

J. F. Kendrick, *in charge*

PROGRESS OF ASSOCIATION WORK

More cows were on test in dairy herd-improvement associations in the United States on January 1, 1938, than ever before. The 1,106 associations that were operating on that date were testing 23,701 herds consisting of 558,993 cows. The greatest number of cows on test previously was 510,714, in 1931. The project is now being conducted in every State for the first time, as well as in Hawaii and Puerto Rico.

During 1937 there was an increase of 114, or 11.5 percent, in the number of associations and 62,431, or 12.6 percent, in the number of cows on test. There was also a net gain of 2,929 association members.

The 23,701 association members voluntarily pay a total of more than $1,000,000 a year to support their local associations and they have received substantial returns on their investment. For example, in 1937 the average butterfat production of cows on test in dairy herd-improvement associations was 320 pounds, while the average production of all cows in the United States was estimated to be only 170 pounds.

During the last 10 years, association members have improved the producing efficiency of their dairy herds until now the average yearly butterfat production of association cows is approximately 30 pounds more than it was a decade ago. This increased producing efficiency means an increased income to association members of approximately $8,000,000 a year.

Although association members receive the first benefits of the program, the influence of the work spreads to dairymen generally. It is impossible to calculate the total value of the herd-improvement association work, but since the results have such widespread application the total value probably amounts to many millions of dollars each year.

Members of dairy herd-improvement associations have gradually improved their herds by eliminating the low-producing unprofitable cows and increasing the number of high-producing profitable cows in their herds. This is illustrated

in table 1, which shows that the percentage of association cows producing less than 325 pounds of butterfat has decreased, while the percentage producing more than 325 pounds has increased, during the period 1926–36, inclusive.

TABLE 1.—*Percentage of dairy herd-improvement association cows at different levels of butterfat production, by years, 1926–36*

Year	Association cows with an annual butterfat production of—						
	Under 225 pounds	225 to 274 pounds	275 to 324 pounds	325 to 374 pounds	375 to 424 pounds	Over 424 pounds	Total
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1926	22	23	23	17	9	6	100
1927	21	23	24	17	9	6	100
1928	19	22	25	17	10	7	100
1929	18	22	25	18	10	7	100
1930	17	21	24	19	11	8	100
1931	17	20	24	19	11	9	100
1932	16	20	23	19	12	10	100
1933	15	19	23	20	12	11	100
1934	15	18	23	20	13	11	100
1935	15	19	23	19	13	11	100
1936	14	19	23	20	13	11	100

PROVED SIRE WORK

Proved-sire records for 1,068 sires that had been used in dairy herd-improvement association herds were tabulated, and the second printed list of proved sires was issued. Copies of the list were placed in the hands of local county agents and cow testers so that dairymen generally might have access to the information.

The list includes the names and records of 992 proved sires whose records were tabulated between April 1, 1937, and April 1, 1938. Only 227, or 23 per cent, of these sires were reported alive when the list was issued. The 992 sires had been mated to cows whose average production was 9,289 pounds of milk (testing 3.9 percent fat) and 364 pounds of butterfat. Although the sires as a group did not improve production in the association herds, practically all of the 992 sires would have raised the production level of the average herd in the United States. As shown in table 2, 476 sires increased production while 516 sires decreased production in the association herds.

TABLE 2.—*Sires that increased or decreased butterfat production, grouped according to the average production of the dams to which they were mated, and the average production of the dams and their daughters in each group*

Butterfat production range of dams (pounds)	Sires proved	Sires that increased production	Sires that decreased production	Average production					
				Dams			Daughters		
				Milk	Butterfat		Milk	Butterfat	
	Number	*Number*	*Number*	*Pounds*	*Percent*	*Pounds*	*Pounds*	*Percent*	*Pounds*
200–224	4	3	1	5,626	3.7	210	6,799	4.0	270
225–249	15	13	2	6,157	3.9	240	6,904	4.1	281
250–274	21	18	3	6,721	3.9	263	7,108	4.0	283
275–299	75	48	27	7,503	3.8	288	7,845	3.9	306
300–324	116	69	47	7,885	4.0	313	8,233	4.0	331
325–349	166	92	74	8,348	4.0	337	8,426	4.1	347
350–374	201	94	107	9,058	4.0	362	8,940	4.1	362
375–399	147	53	94	9,941	3.9	386	9,568	3.9	375
400–424	113	50	63	10,893	3.8	412	10,374	3.8	399
425–449	61	23	38	11,313	3.9	439	10,780	4.0	427
450–474	40	7	33	12,254	3.8	464	11,324	3.8	427
475–499	16	2	14	12,410	3.9	484	11,282	3.8	431
500–524	7	3	4	9,731	5.3	511	8,706	5.4	473
525–549	6	1	5	14,757	3.6	535	13,105	3.8	495
575–599	3	0	3	17,506	3.3	586	15,004	3.3	497
600–624	1	0	1	16,283	3.7	600	14,761	3.4	498
Total or average	992	476	516	9,289	3.9	364	9,145	4.0	364

The major purpose of the sire-proving program is to provide information so that it will be possible to place proved sires in herds in which they will be capable of holding or raising production. Most of the 516 sires that decreased production had been mated to high-producing dams. They would probably have held or raised production had they been mated to dams of their own production class or lower.

IDENTIFICATION AND PRODUCTION RECORD PROJECT

In the past, the greatest value of the dairy herd-improvement association program has been that it provided the dairymen with feed and production records on individual cows, which enabled them to cull their herds intelligently and to feed the remaining cows according to production. Now, in addition to the fundamental data on culling and feeding, dairymen are obtaining information that will enable them to conduct a progressive breeding program.

The identification and production record project, which was inaugurated several years ago as a part of the dairy herd-improvement association program, forms the basis for a Nation-wide dairy-cattle breeding program. Under this project the identification of every animal in the association herds is permanently established. Grade animals and their offspring are eartagged for identification and their eartag numbers are recorded in the same manner as the identification records of registered animals.

With the identification of all animals in association herds established, the production records obtained in nearly 24,000 herds can be analyzed for the purpose of locating those animals and families that possess the ability to transmit high milk- and butterfat-producing ability to their offspring. The purpose of the program is to disseminate the influence of the superior association herds, which have an average butterfat production of 320 pounds per cow, throughout the national dairy herd of approximately 25,000,000 cows, which has an average butterfat production of only 170 pounds per cow. This will be done largely through the use of good proved sires.

When the program is in full operation, many dairymen for the first time will have an opportunity to obtain the services of sires that are known to have the ability to transmit an inheritance for a high level of milk and butterfat production. Data will eventually be available on every sire used in every association herd. The production efficiency of dairy herds in general may then be consistently and systematically improved. Better replacement stock will also be available. This should greatly reduce the losses dairymen now suffer from raising poor replacement stock that must be discarded as soon as its inferiority is established.

All 48 States are cooperating in the project. Association testers have been trained to conduct the project in the local associations and to report the identification and production records in the proper form. At the close of the year more than 305,000 identification records and more than 107,000 production records had been reported for permanent recording.

As rapidly as sufficient data accumulate proved-sire records are tabulated and returned to the States in which the sires are proved. Every 6 months a list of all association sires whose records were tabulated during the preceding 6 months is issued in order that dairymen may have current information on sires that have been proved.

During the past year sufficient data have accumulated on 131 herds to warrant tabulation. The data are used by the various State colleges in making genetic analyses of the herds. The analyses will enable each dairyman to evaluate the various family lines within his own herd so that he may use only his best cow families in building his future herd.

COOPERATIVE BULL ASSOCIATIONS

There were 166 cooperative dairy-bull associations in operation January 1, 1938, with the total membership of 2,561 dairymen owning 734 dairy bulls cooperatively.

All these associations have the facilities for conducting a progressive, long-time, dairy-cattle breeding program. They are completely organized and have the necessary officers to conduct the business of the associations properly. Many of the associations are incorporated. At least one meeting of the membership is held each year. Each association has three or more blocks, in each of which is placed a bull owned by the association (not by individual members).

When an association meets the above standards it is usually capable of rendering efficient service to its membership year after year. Too often cooperative bull associations are loosely organized and the business affairs of the organization are neglected, with the result that the organization operates for only a few years and then disintegrates.

Although the members of a defunct bull association seldom, if ever, lose money because of the failure, they are deprived of the opportunity of benefiting from a long-time dairy-cattle breeding program.

Bull associations provide ideal facilities for the extensive utilization of superior sires proved in dairy herd-improvement associations. Not only are the bulls kept alive and in active service for a longer period than if they were owned by individuals but their superior inheritance is spread to a greater number of dairy herds. At present only 26 of the bull-association bulls are proved. However, this number will probably be greatly increased in the future, as the bull-association bulls are used in dairy herd-improvement association herds where they will be automatically proved through the sire-proving program.

DAIRY-FARM RECORDS

The dairy-farm record project is a cooperative effort by the Bureaus of Dairy Industry and Agricultural Economics to analyze and summarize complete farm records obtained in dairy herd-improvement associations in order that information of value on all phases of dairy farming may be made available to dairymen generally.

When the work was started during the fiscal year 1937 it was recognized that the project was of considerable magnitude and that it should first be introduced in only a few associations and only on a few farms in each of these associations. Of the 13 States that started the record work on a cooperative basis last year, 5 completed dairy-farm records during the fiscal year 1938. The records from Louisiana, Oklahoma, Vermont, and West Virginia have been received by the cooperating Bureaus for summarization and analysis, whereas those for Wisconsin have been analyzed by the State cooperating agency and furnished to the cooperating Bureaus with a summary of each farm record. Some of the other cooperating States have indicated their intention to forward farm-record books to the cooperating Bureaus for summarization and analysis when they are completed. A total of 76 dairy-farm records have been summarized. Because of the limited number of records summarized the first year no general studies have been made for publication.

The project has been received favorably by the dairymen on whose farms complete records have been kept. Reports from States in which a year of record work has been completed indicate that most of the dairymen are continuing to keep records the second year. The need for complete records on dairy-farm operations will continue to grow as it becomes more necessary to operate each farm enterprise efficiently and also to maintain proper balance between the various enterprises on each farm, in order to obtain maximum profits for the farm as a whole. The project will be extended slowly and the number of farms keeping records will be gradually increased each year.

BREEDING, FEEDING, AND MANAGEMENT INVESTIGATIONS

R. R. Graves, *in charge*

THE EXPERIMENTAL BREEDING HERDS AT BELTSVILLE, MD.

BREEDING EXPERIMENTS WITH HOLSTEIN-FRIESIAN CATTLE

Progress on the project to develop strains pure in their inheritance for a high level of production through the continuous use of unrelated proved sires was interrupted by the loss of King Ormsby of Iodak, selected as the sixth in this series of sires. He died after a 6-month period of service and left only three daughters in the herd. His predecessor, Chief Piebe Ormsby Burke, continues serviceable although he is past 14 years of age. The line-breeding phase of the project is going forward and additional daughters of Pride Ormsby Gerben Colantha Ona have been added to the second line-bred group.

The present status of the breeding herd can be shown to best advantage in tabular form, and table 3 lists the number of daughters of each sire now in the herd and the average milk and butterfat production records of those that have been tested. The records are given on a mature-equivalent basis.

TABLE 3.—*Holstein-Friesian sires with daughters still in the herd, and the average production of the daughters that have been tested*[1]

Sire	Class of daughters	Daughters in herd	Daughters with records	Average production	
				Milk	Butterfat
		Number	*Number*	*Pounds*	*Pounds*
Varsity Derby Matador	Outbred	7	7	20,750	713
Do	Inbred	2	2	17,135	631
Double Gerben Colantha Hero	do	4	0		
Pride of the Bess Burkes	Outbred	3	3	18,957	724
Count Piebe Hengerveld Ormsby	do	5	5	19,632	711
Chief Piebe Ormsby Burke	do	27	10	19,559	747
Do	Inbred	4	0		
King Ormsby of Iodak	Outbred	3	0		
Sir Gerben Colantha Rube	Line-bred	5	5	19,672	659
Do	Inbred	4	1	17,506	612
Pride Ormsby Gerben Colantha Ona	Line-bred	14	4	21,098	832
Do	Inbred	4	0		
Chief Piebe Gerben Colantha Watson	Line-bred	4	0		
Twice Chief Piebe Pride Gerb Col Wat	do	3	0		
All sires	Outbred	45	25	19,835	727
	Line-bred	26	9	20,306	736
	Inbred	18	3	17,292	625
Total or average		89	37	19,741	721

[1] Production on a mature-equivalent basis.

In considering these figures it is well to bear in mind that no selection is practiced in this herd and all records are made under standardized conditions. The averages could be materially improved by culling the cows with the lowest records, some of which are in advanced years, but the practice has been to retain all females as long as they are of use to the breeding projects.

The average butterfat production of the outbred and line-bred groups now in the herd is about equal, but that of the small inbred group is far below. The 34 outbred and line-bred females now in the herd average 730 pounds of butterfat. In the selected group of foundation cows from which this herd is descended there were 34 cows with production records that averaged 678 pounds of butterfat. The conditions under which all production records in this herd were made have been unchanged. No other females have been added to the group, no selection has been practiced, and all females have been raised and developed, so that it is fair to attribute this increase of 52 pounds in the average butterfat production to the superior germ plasm of the five proved sires that have been used.

During the year, 15 cows completed official production records that averaged 15,880 pounds of milk and 597 pounds of butterfat, their average age being 3 years 5 months. All but three were under mature age. The highest individual record was 23,616 pounds of milk and 905 pounds of butterfat, by a daughter of Varsity Derby Matador.

A complete analysis of the Holstein-Friesian foundation herd and the first outbred generation sired by Denton Colantha Sir Rag Apple has been prepared for publication.

BREEDING EXPERIMENTS WITH JERSEY CATTLE

The Jersey herd now numbers 76 females (24 in the Owl-Interest group, 12 in the Sophie-Tormentor group, 32 in the Raleigh group, and 8 in the family crossing project). Twenty-one are line-bred, 45 outbred, and 10 inbred. During the year 17 cows completed Register of Merit records, which averaged 11,129 pounds of milk and 604 of butterfat at the average age of 3 years 9 months. Five were mature cows. Three qualified for American Jersey Cattle Club gold medals and five for silver medals.

As the herd is made up today, 29 of the 76 females have completed production records, which average 13,529 pounds of milk and 698 of butterfat. These are descendants of the selected foundation herd, which averaged 11,626 pounds of milk and 624 of butterfat. As all records were made under comparable conditions and no selection of females has been practiced, this improvement is undoubtedly due to the influence of the germ plasm of the proved sires that have

been used to produce the present herd. Like the Holstein herd, the Jersey herd is the product of a long-continued program in which proved sires are used to develop high-producing strains of dairy cattle.

Eight of the proved Jersey sires used over a period of years now have a total of 86 production-tested daughters, which average 12,760 pounds of milk and 674 of butterfat. The dams of these daughters averaged 11,823 pounds of milk and 634 of butterfat, which indicates an increase of 937 pounds of milk and 40 of butterfat by the daughters. In this group, the daughters topped by only one proved sire averaged 662 pounds of butterfat; those carrying two crosses of proved sires averaged 682, and those with three or more crosses averaged 705 pounds. This illustrates the cumulative effect of the use of sires carrying superior germ plasm and confirms some of the findings of the germ-plasm survey reported in the 1936 Yearbook of Agriculture.

The procedure followed in these breeding projects resulted in line-bred and outbred daughters from the various proved sires. Sixty-two of the eighty-six were outbred, and they averaged 675 pounds of butterfat while the 24 line-bred daughters averaged 672 pounds. The quality of the sire is transmitted to his daughters regardless of whether or not their dams are related to their sires. This should encourage breeders to use satisfactorily proved sires regardless of family.

INBREEDING GRADE HOLSTEIN-FRIESIAN CATTLE

After several generations of close inbreeding with grade Holstein-Friesian cattle it was found that the birth weight of calves was reduced, their growth was slowed up, and the vigor of both calves and mature animals was impaired. There is no definite indication, however, that the fertility has been adversely affected. Mating the inbred animals with unrelated animals has resulted in calves that are fully or nearly normal in birth weight and vigor.

RELATION OF CONFORMATION AND ANATOMY TO PRODUCING CAPACITY

ANTE-MORTEM AND POST-MORTEM STUDIES

The practice of obtaining ante-morten measurements of conformation and post-mortem weights and measurements of the internal organs and body parts has been carried on without change in procedure. Two reports on cows slaughtered were prepared at the Florida Agricultural Experiment Station, 3 at New Hampshire, 5 at North Dakota, 4 at South Carolina, and 18 at the Beltsville station—a total of 32 for the year. The total number of such reports filed to date on cows with records of production is 656. Of this number 84 were prepared at South Carolina, 81 at Pennsylvania, 48 at New York (Cornell), 37 at Florida, 28 at North Dakota, 23 at North Carolina, and from 2 to 14 at each of 14 other State experiment stations. A total of 254 reports have been prepared at the Beltsville station. During the year the New Mexico Agricultural Experiment Station has been added as a cooperator to obtain similar data on milk goats.

GROWTH, CHANGES IN CONFORMATION, AND STUDIES OF THE UDDER

No noteworthy changes have been made in the procedure of obtaining conformation-anatomy-production data on heifers during their periods of growth and development and on cows during lactating life. In making a permanent record of growth and changes in conformation in animals in the breeding herd 227 sets of body measurements on 138 different heifers and cows, and 326 photographs of 88 different heifers and bulls from birth to 12 months of age have been obtained.

As in recent years much emphasis has been placed on studies of comparative udder development in individual growing heifers, of many different characteristics and of the performance of the udder during lactating life, and of the anatomy of the udder and the physical properties of its tissue at the time of slaughter. In this connection 284 detailed examinations were made of the udder development of 80 different heifers from birth to 18 months of age and 334 examinations of 74 different cows of lactating age. Twenty-three similar examinations were made on cows immediately before slaughter as a preliminary to post-mortem udder studies. Photographs were obtained of the udders of 22 heifers at 18 months of age, and of 32 cows of lactating age.

During the year capacities of amputated udders were determined for 19 animals of which 10 were lactating cows, 6 were nonlactating cows, 1 was a cow that failed to "make up" udder and to produce normally after calving, and 2 were nonbreeding heifers. Measured capacities are now available for 367 udders. Capacities for 157 lactating udders average 53.22 pounds as compared with an average of 31.98 for 104 nonlactating udders, and 44.75 pounds for the 261 udders in both groups. Capacities for calves increase steadily from an average of 0.06 pound at an age of less than 3½ months to an average of 6.64 pounds at an age of 12½ to 18½ months. Capacities for freemartins show a similar but slightly less marked increase, from 0.05 pound at an age of less than 3½ months to 4.29 at an age of 12½ to 18½ months. Apparently the mammary glands of the freemartin are slightly less advanced in development than are those of normal females.

PERFORMANCE OF INDIVIDUAL QUARTERS OF THE UDDER

A summary of the study of the performance of individual quarters of the udders of 94 cows showed that, on an average, 29.2 and 29.0 percent of the total milk yield was obtained from the left and right rear quarters, respectively, and that 20.2 and 21.6 percent was obtained from the left and right front quarters, respectively—making the average 58.2 percent from the rear and 41.8 from the front quarters. The right rear quarter most often yielded the highest quantity and the left front quarter the least of the four.

More milk per minute was obtained from the rear than from the front quarters throughout the entire period of milking. Quantities per minute for the first 2.5 minutes, the second 2.5 minutes, and the remainder of the milking period were 1.18, 0.77, and 0.34 pounds, respectively, for the front quarters and 1.36, 1.13, and 0.58 pounds, respectively, for the rear quarters. Despite this difference in rate, however, the rear quarters were emptied more slowly than the front, the percentage of the total yield milked out at the end of 2.5, 5, and 7.5 minutes being 49.1, 81.1, and 92.8 for the front quarters and 43.1, 76.2, and 91.2 for the rear quarters.

Wide variations occurred in yields of the different quarters of the udder, even between the two front or the two rear quarters of the same udder. The rates of milking also differed greatly, but the variations between cows were greater than the variations between quarters of the same udder. Cows classed as fast milkers usually milked rapidly from all quarters.

The rear quarters not only milked at a faster rate but the higher rate continued longer than in the front quarters. The peak flow (1.5-minute period having the highest rate per minute) came later in the rear than in the front quarters. Massaging the udder near the close of the milking period resulted in obtaining more milk from the rear quarters than from the front. In general, the results obtained with Holsteins and Jerseys were similar. However, the group of closely related inbred grade Holsteins gave relatively less quantity from the front than from the rear quarters and showed corresponding wider differences between the front and rear quarters in the average rate of milking.

Relative milk yields from the separate quarters and comparative rates of milking from the front and rear quarters were not appreciably affected by differences in yield at night and morning milkings, by stage of lactation, or by successive lactation periods. Relative milk yields of individual cows, however, did change somewhat from one lactation to another.

Lower milk yields were rather consistently accompanied by correspondingly lower rates of milking, but there was very little change in the percentages of each quarter's total yield milked out in the first 2.5 or in the first 5.0 minutes of milking.

It has been shown that in the 94 cows studied 41.8 percent of the total yield was produced by the front quarters and 58.2 percent by the rear quarters of the udder. In this connection it is of interest to note that, as a part of the regular routine studies of the udder, the capacity of the secretory system and the depth of the glandular tissue above the front and rear teats are measured after the udders are amputated at the time of slaughter. A tabulation of 185 cows since July 1, 1931, shows that the average measured fluid-holding capacities of the front and rear quarters were 4,880 and 5,666 cubic centimeters, respectively. The ratio of front capacity to rear capacity for this group is therefore 0.86. The average depth of gland tissue was 6.38 inches above the front teat and 10.29 inches above the rear teat, a front-rear ratio of 0.62. The average quantity of milk obtained from the front and rear quarters of the 94 cows

timed with the four-unit milker gave a front-rear ratio of 0.72. The difference in depth of gland tissue is more marked than the difference in capacity. The ratio was higher for capacity and lower for depth in the nonlactating than in the lactating udders, showing a smaller relative difference in capacity and a greater relative difference in depth between front and rear quarters in the nonlactating than in the lactating udders. The breeds differed somewhat with regard to these ratios. On the whole the ratios for quantity of milk produced, for measured capacity, and for depth of gland tissue of the front as compared to the rear quarters of cow udders appear to be fairly similar.

UDDER SPECIMENS

A large quantity of specimen material obtained from udders over a period of several years was classified and mounted on panels for ready display to farmers, breeders, scientific workers, and educators visiting at Beltsville. These panels are kept in a preserving solution when not on display and can be brought out for observation on a moment's notice.

Two panels of particular interest carry dissections and cross sections of the udders of calves from birth up to the age of first calving. The striking fact about these specimens is that the calf udder at from 2 to 4 months of age shows such details of structure as teat canals, cisterns, ducts, etc., as are found in older animals, and that the parts are of about the same relative size and development as at maturity.

Four panels devoted to a study of mammary-gland structure in cows of high as compared to low production, show udder sections from lactating Holsteins, from nonlactating Holsteins, from lactating Jerseys, and from nonlactating Jerseys.

The lactating udders of both breeds were much heavier in the high- than in the low-producing groups. There was comparatively little difference in empty weight in the nonlacating udders. Despite the fact that the cows in all groups were slaughtered at widely different stages of lactation the importance of size in the lactating udder is indicated. Among the lactating cows the udders in the low-producing group were only 73.7 percent as heavy as those in the high-producing group in the case of Holsteins and only 61.2 percent in the case of Jerseys. In fact, this difference in size is more apparent than difference in any other visible characteristic noted.

RELATION BETWEEN CONFORMATION AND ANATOMY

In studies of body measurements and anatomical data on cows slaughtered in a packing house much wider variations were found to occur in the weights and measurements of the internal organs than in the external body measurements. Heart weight was found to be moderately correlated with the depth of chest and with the depth, length, and volume of the thoracic cavity, but not highly correlated with width of body, width of thoracic cavity, height or length of body, or with the other internal organs except the liver. Correlations for lung weight were lower in most cases than those for heart weight, the correlation for body length being the outstanding exception. The low magnitude of the correlation coefficients for length of intestines casts considerable doubt on the possibility of efficiently judging the feeding capacity of cows on the basis of their external conformation. Live weight was highly correlated with body bulk and many of the individual body measurements, the most outstanding of which was the circumference of chest or heart girth, a measurement employed for generations in Denmark and in some sections of the United States as a basis for estimating live weight in cattle. The only internal organs the weights of which were highly correlated with live weight were heart and liver. There was no relation between live weight and brain weight. Correlations for body widths were in most cases definitely lower than corresponding ones for body depths. The difference is most marked at the forechest, and becomes progressively less at the rear chest and paunch. Certain breed differences are indicated.

FEEDING AND MANAGEMENT INVESTIGATIONS AT BELTSVILLE, MD.

SILAGE INVESTIGATIONS

First-cutting alfalfa that was dried in the field to a dry-matter content ranging from 42 to 73 percent was successfully preserved in a concrete silo 14 feet in diameter. The total loss of dry matter through spoilage on top and through

fermentation was estimated to be 7.5 percent. The carotene content averaged 64 parts per million of dry matter when the crop material was put in and 48 when it was removed. The pH value of the silage ranged from 4.61 to 4.78, a much lower acidity than is commonly considered necessary for proper preservation of the silage. A feeding experiment with milking cows showed that this silage, on the basis of dry matter contained, was fully equal to U. S. No. 2 leafy alfalfa hay. This experience with siloing low-moisture alfalfa demonstrates the feasibility of storing partially cured hay crops in a silo as silage instead of in a mow or stack, as hay.

Previous work showed that the addition of a mixture of hydrochloric and sulphuric acids to crop material as it was put in the silo impaired the palatability of the silage; and the sulphuric acid, rather than the hydrochloric acid, was suspected of being responsible for this condition. A trial this past season, however, showed that hydrochloric acid used alone impaired the palatability.

Corn stover that had been in the shock for about 50 days and that contained 56 percent of dry matter was chopped fine and siloed. Similar material was siloed with the addition of 87 pounds of water to each 100 pounds of stover. The lot to which water had been added showed a greater loss of dry matter and was distinctly less palatable than the other lot. Cattle ate smaller quantities of both lots, however, than of normal corn silage or silage made from the grasses or legumes.

In connection with other silage investigations, data have been accumulated that show the effect of length of cut on the storage capacity of silos.

In filling small (4 by 8 feet) experimental silos, chopping the material in ¼-inch lengths increased storage capacity over chopping in ¾-inch lengths by 7.8 percent for soybeans with 71 percent of moisture, 5 percent for alfalfa with 58 percent of moisture, and 7.1 percent for corn silage with 75 percent of moisture.

In filling snow-fence silos (about 15 feet in diameter by 14 feet 6 inches high) with corn containing 72 percent of moisture, storage capacity was increased by 7.5 percent when the material was chopped in ¼- instead of ¾-inch lengths.

In filling concrete silos (14 feet in diameter) with corn silage having 74 per cent of moisture, to a depth of 41 to 42 feet and refilling after the material settled, storage capacity was increased by 7.9 percent by chopping the material in ¼- instead of ¾-inch lengths.

In addition to increasing the storage capacity of the silo, the short-cut material packed tighter in the silo and had less spoilage on top; and in the case of the silages made of alfalfa or soybeans the short-cut material was more palatable.

Silos made of four 4-foot widths of slatted fencing (snow fence) and lined with special paper were filled with corn. The losses of dry matter resulting from both spoilage and normal fermentation were as follows: With corn having a moisture content of 64 percent and stored 90 days from filling time to the start of feeding, the loss was 17 percent; with a moisture content of 72 to 74 percent and storage periods of 110, 147, and 170 days, the losses were 31, 41, and 37 percent, respectively. The losses the previous year for storage periods of 30 and 60 days were 10 and 13 percent, respectively. The investigations indicate that for short-time storage the snow-fence silo is satisfactory but that the losses from longer storage are excessive.

A modified pit-stock silo similar to that used and described by investigators at the Western Washington Experiment Station was tried at Beltsville in October 1937. A stack of green, unchopped, orchard grass aftermath was built in a pit 2½ feet deep by 10 feet wide and the entire surface of the stack was covered with earth to a depth of from 8 to 12 inches or more. A similar pit stack was made of mixed Kentucky bluegrass and lespedeza. The losses in the stack of orchard grass were not determined, but those in the stack of bluegrass and lespedeza were 28 percent. The silage produced by this method has a good odor and is highly palatable if the moisure content is not too high at the time of storage and if surface and seepage water are kept out. High-moisture silage not only has a strong, clinging odor but it is also much less palatable than dried silage.

This investigation shows that by exercising some simple precautions excellent silage can be made without any cash outlay whatever for materials or for implements other than those used in making hay. For this reason, and also because of the labor cost of covering the stack and of removing the silage, this method of siloing grass is likely to find more favor on small farms than on large farms.

PASTURE INVESTIGATIONS

Two plots of Kentucky bluegrass that have been clipped monthly to heights of 1½ and 3½ inches, respectively, for 7 years, continue to show yields in favor of the low clipping. This indicates that close grazing of the grass in pastures that are being grazed in rotation is a desirable practice.

The applications of superphosphate and lime to clipped plots of Kentucky bluegrass during a period of 5 years have led to insignificant increases in the yields of herbage. A portion of these plots is now being grazed to see if the same findings will apply when the plots are grazed instead of clipped.

In another long-time investigation to determine the most profitable method of fertilizing pastures, the second season's yields by grazed plots, as measured by pluckings from protected areas, showed that applications of either nitrogen or barnyard manure improved the yield some 11 to 14 percent but that applications of phosphorus and potassium did not improve the yield.

Four years of experience with annual pasture crops at Beltsville indicates that rye and vetch is a more dependable crop than Italian ryegrass for late-fall and early-spring pasturage. Oats, Sudan grass, and soybeans have made rather small yields. Because of the small yields and the expense of annual seeding, the pasturage obtained from these crops has been relatively more costly than that from permanent pastures.

In 1937 an investigation was started to test the possibilities of crimson clover for increasing spring pasturage at the Beltsville station. Seedings were made on August 23, September 27, and October 20, with inoculated and uninoculated seed and on unfertilized pasture and on one pasture plot fertilized with 350 pounds of superphosphate per acre and on another plot fertilized with manure at the rate of 8 tons per acre. Alternate freezing and thawing in the winter of 1937–38 caused considerable heaving of the ground, and there was a heavy mortality among the crimson clover plants. It was estimated on May 1 that approximately 30 percent of the stand had survived on the unfertilized and phosphate-treated plots. The seeding made on October 20 was not successful. The spring was cool and dry and growth of crimson clover on all plots was uneven. The harvesting of the crop through May, from cages 4 by 4 feet on areas representing good stands, indicated no increase in yield as a result of inoculation; on the unfertlized plots crimson clover increased the yield of air-dry material by 590 pounds (calculated to an acre basis) or 47 percent; on the superphosphate-treated plots crimson clover increased the yield by 478 pounds or 31 percent; and on the manured plots crimson clover increased the yield by 243 pounds or 10 percent.

INPUT AS RELATED TO OUTPUT IN MILK PRODUCTION

The Bureau is conducting feeding investigations, under a Bankhead-Jones grant, in cooperation with the Bureau of Agricultural Economics and 10 State experiment stations. As the results become available, the evidence is increasing that the quantities of nutrients specified by the Haecker standard are too low for the most economical milk production. This is especially true if the cows are spare in flesh and if the roughage is not of good quality.

An examination of records made by individual cows in different years in the dairy herd-improvement associations of 12 States shows that the longer the interval between calvings the greater the production. This does not mean, however, that the longer calving intervals were more profitable, for the average daily production was greater during the shorter intervals. For example, a calving interval of 317 days resulted in a total production for the lactation of 9,023 pounds of milk, or an average of 28.5 pounds a day, while a calving interval of 400 days resulted in a total of 10,193 pounds of milk, or an average production of 25.5 pounds a day. Factors for adjusting the production made with calving intervals of more or less than 365 days in length to an even 365 days have been prepared.

A similar study to determine the influence of the length of the preceding dry period upon the production shows that the longer the dry period the greater the production. A dry period of 1 to 2 months compared with a dry period of less than 1 month resulted in 7 percent more milk; a dry period of 3 to 4 months resulted in an additional 6-percent increase. Here, again, because of the cost of maintaining dry cows, the highest production is probably not the most economical production.

The two studies of calving intervals and dry period combined indicate that a calving interval of 12 months, of which 2 months are the dry period, may not be far from the most profitable practice.

Carefully selected records from 12 States show that when the quantity of milk produced decreases as a result of environmental conditions and stage of lactation, the percentage of butterfat in the milk goes up, and vice versa. Two exceptions to this rule are noted as follows: (1) Extremely warm weather may lead to a reduction in both the milk and the percentage of butterfat; and (2) the percentage of butterfat may continue to fall for a short time after the peak of milk production has been passed.

A study of over 15,000 records of individual cows in dairy herd-improvement associations of 12 States shows that the months of calving most favorable for high production are October and November, and the month least favorable is July. The difference, however, between the most favorable and least favorable months amounts to only a little over 200 pounds of milk. The smallness of this difference comes about through the fact that the lower peak of production of the cows calving in July is offset in some measure by the better maintenance of production in the later stages of lactation.

WORK AT THE FIELD EXPERIMENT STATIONS

GENERAL

On June 30, 1938, the seven field-station herds had a total of 488 dairy cattle (422 females and 66 bulls). In addition 126 bulls from these herds are loaned to cooperators in the vicinity of the stations, where they are being proved for their ability to transmit the inheritance for high levels of milk and butterfat production. Data were obtained for proving several sires at the Huntley, Woodward, and Hannibal stations and good records are coming in from the daughters of several bulls at the other stations. A young Guernsey sire from the Columbia station was loaned to the University of Puerto Rico. Klaver Gerben Ormsby Paul 650650, a sire proved at the Huntley station, was sent to the Woodward station where he is now in service.

Cooperation with the United States Department of Justice is being continued, and to date 28 bulls have been loaned to the Federal-penitentiary herds.

Table 4 shows the number of official records made at all stations and the average mature-equivalent milk and butterfat production by years from 1930 to 1938, inclusive.

TABLE 4.—*Number of official records at all field stations and the average milk and butterfat production, 1930–38 (all records calculated to maturity)*

Year	Records	Milk production	Butterfat production	Year	Records	Milk production	Butterfat production
	Number	*Pounds*	*Pounds*		*Number*	*Pounds*	*Pounds*
1930	27	15,306	539	1936	62	13,680	546
1931	25	14,053	548	1937	61	14,002	565
1932	50	14,671	584	1938	69	13,504	569
1933	55	13,679	555				
1934	81	11,791	503	Average (weighted)	494	13,596	548
1935	64	13,703	538				

For the most part these records have been made by first-calf heifers. An attempt is made to obtain a measure of the producing capacity of all heifers with first calf, for use in the inheritance studies. Occasionally a heifer's record does not appear to be up to her inherited ability and she is retested at a later lactation period, but the heifers that make records that appear to be normal are rarely retested. During these tests they are milked three times a day and usually are on pasture during the pasture season. They are kept either in stanchions or in pen barns, six to eight cows to a pen, depending on the type of barn at the particular station. These records are therefore not selective. Every heifer that freshens is tested unless she is in bad health.

HUNTLEY, MONT., STATION

The experiment to compare the effect on the yield, on the stand, and on the feeding value for dairy cattle, of cutting hay at the initial-bloom, half-bloom, and full-bloom stages has been completed. Observations in the spring of 1938 showed little noticeable difference in the stands of alfalfa on the three 5-acre plots that had been cut for 3 years at the above-mentioned stages. There was some indication of retarded growth in one part of the initial-bloom plot, but this difference was probably the result of a late fourth cutting (aftermath) for 1937.

The average yield of field-cured hay per acre for the 3 years was 8,937 pounds of hay cut in the initial-bloom stage; 8,843 pounds of hay cut at the half-bloom stage; and 6,940 pounds cut at the full-bloom stage. The yields of dry matter per acre were in about the same ratio. The 3-year average crude-protein content was 18.2 percent for the hay cut in the initial-bloom stage, 18.3 for the half-bloom stage, and 15.7 for the full-bloom stage. The crude-fiber content of the hay cut at the full-bloom stage was considerably higher than that of the hay cut at the earlier stages. The amount of green color was considerably greater in the hay cut at the early stages, averaging 73 percent for the initial-bloom and half-bloom stages as compared to 64 percent for the full-bloom stage. The amount of leaf averaged 46 percent for the initial-bloom and half-bloom stages as compared to 41 for the full-bloom.

The feeding experiments indicate but little difference in the amount of hay consumed by balanced groups of cows for entire lactations. There is evidence, however, that the hay cut at the initial-bloom stage was superior, since the cows consumed only 1.34 pounds of this hay for each pound of milk they produced whereas they consumed 1.57 of the half-bloom and 1.69 pounds of the full-bloom hay for each pound of milk they produced. Digestion trials with sheep are now being conducted with representative lots of the hay cut at the three stages in 1937 and when the data are available more accurate conclusions can be drawn.

The experiment on the relative value for milk production of hay and silage made from immature pasture herbage, which was referred to in the 1936 annual report, has been concluded and the results are ready for publication.

For several years an experiment has been in progress with calves and heifers to measure the effect of continued skim-milk feeding on the growth and later production of the animals. The ordinary practice is to remove skim milk from the ration at 6 months of age. To date comparative monthly weights and other data are available on 24 calves that received skim milk to 6 months of age; on 22 calves that received skim milk to 12 months of age; on 22 heifers that received skim milk to 18 months of age; and on 23 heifers that received skim milk to 24 months of age. There was a slight slowing up of the rate of growth for each group of heifers at the time skim milk was removed from the ration. This was most pronounced for the calves in the 6-month and 12-month groups. From the standpoint of monthly body weights there was no advantage in continuing the feeding of skim milk beyond the age of 12 months.

A study of the breeding records of the heifers in the four groups gave some evidence that skim milk fed beyond 12 months of age may have had some beneficial effect in overcoming the difficulty commonly experienced at this station and at other stations in getting heifers to conceive for the first calf. The groups that received skim milk to 6 and 12 months of age required an average of 4.42 services for the first conception, while the groups that received skim milk to 18 and 24 months of age required an average of 3.00 services for the first conception. The record for the heifers that received skim milk to 18 and 24 months is not a good one, but it is much better than for those that received skim milk to 6 and 12 months of age.

Seventeen young cows were loaned to the Utah Agricultural Experiment Station under a cooperative agreement.

WOODWARD, OKLA., STATION

Two years' results are available for the heifer-wintering experiments. Three groups of Holstein heifers were fed for an average of 111 days each winter, as follows: Group 1 received sorgo (cane) silage ad libitum plus 1 pound of cottonseed meal per day; group 2 received sorgo silage ad libitum plus 2 pounds of cottonseed meal per day; and group 3 received alfalfa hay, sorgo silage, and 2 pounds of a grain mixture per day. Heifers in all groups were above standard

weight at the beginning of the trials and made greater than standard gains for the feeding periods. While the gains by all groups were satisfactory, the feed costs per 100 pounds gain in weight were $6 for group 1, $6.83 for group 2, and $9.02 for group 3. Sorgo silage ad libitum plus 1 or 2 pounds of cottonseed meal per head daily constitutes an efficient and economical winter ration for Holstein heifers 18 months old or older.

One sire was proved during the year in a cooperator's herd. Five daughters' records averaged 12,227 pounds of milk and 425 pounds of butterfat (mature equivalent) as compared to an average of 11,361 pounds of milk and 378 pounds of butterfat for their dams. This sire had previously been slaughtered, however, because he reacted to Bang's disease.

In the breeding herd, Friend King Paul Colantha Walker 560023 has sired 21 daughters, 17 of which have been raised. Six of the latter have recently calved and are now on official test. This sire is still in service but is being used only to a limited extent because of the small number of females in the herd that can be bred to him. His daughters are being bred to Klaver Gerben Ormsby Paul 650650, the fifth consecutive proved sire used at the Woodward station.

MANDAN, N. DAK., STATION

The ice well continues to give satisfaction with practically no costs for upkeep and repairs. In the last few years block ice was hauled from the river and placed in the well. This has proved somewhat more satisfactory than freezing small quantities of water each day during cold weather. By hauling river ice, the entire job can be completed in 1 or 2 days, while the work of freezing small quantities daily may extend over a month or two. The 9 years' results show that refrigeration is furnished for approximately 4 months during the summer from May 15 to September 20.

Friend Ona Paul Colantha 548178, the fourth consecutive proved sire used in the Mandan herd, has sired 51 daughters and 39 sons in this herd. Of the 51 daughters 42 are still in the herd. His first daughter has recently completed an official record of 17,280 pounds of milk and 539 pounds of butterfat at 2 years 2 months of age. Eleven other daughters now on test are producing at a high level.

The experiment to determine the effect of light applications of barnyard manure on native pasture is being continued. No detrimental effect on the grass is noticeable after 2 years' applications. Because of low rainfall in this section manure applied to land decomposes very slowly. For this reason it has been thought that manure may burn the crop to which it is applied, and applications of manure to such crops as pasture have not been advocated.

Seeding sweetclover on native sod did not prove successful this past year, probably because of the extreme dry weather. This project is being continued.

JEANERETTE, LA., STATION

For several years a small experimental drum-type mechanical drier has been used to cure roughage crops grown on the station farm. For the 1937 cropping year 171 tons of hay were harvested, of which 69 were cured in the drier. The capacity of the machine varied from 400 to 1,200 pounds of dried hay per hour, depending upon the moisture content and the kind of material to be dried. The season average was 896 pounds per hour.

Many of the fields received applications of lime and phosphorus during this and last year. These applications have not been so effective in bringing back the stand of white clover as was expected. An experiment was started last year to show the effect of lime alone, phosphate alone, lime and phosphate, and lime and manure on a series of small pasture plots. A portion of each plot was reseeded to white clover and a portion was left unseeded as a check. The reseeded plots contained a much heavier growth of clover this spring than the plots that were not seeded. Other fields on which white clover was seeded on newly prepared seedbeds also had very fine stands and gave fine pasturage from February to June, inclusive. Further observation should determine how long these newly seeded stands will persist. In view of the greatly increased carrying capacity of the newly seeded fields it may be advisable to seed at least one pasture to white clover each year. Lespedeza will be sown on fields that are not sown to white clover in an effort to provide good pasture from June until late in the fall.

The evidence continues to indicate that the nasal disease is contracted while the animals are on pasture. Heifers that have not had access to pasture are

not infected. Even the most severely infected animals do not appear to be affected by the disease in the winter when they are not on pasture. Some of the cows that had had severe infections and that were being fed on dry roughage rations throughout the year did not appear to suffer from the disease during the summer months. This, too, appears to indicate that the animals acquire the infection while they are on pasture.

Sweet's Raleigh Boy 279769, the proved Jersey sire purchased for the herd in September 1936, died in August 1937 as a result of paralysis. He sired eight daughters, of which seven are in the herd. He has been replaced by Tiddledywink Fauvic Actor 288048. The latter bull was bred at the Beltsville station and had been loaned to the Tennessee Agricultural Experiment Station, where he was proved. Reports from that station indicate that his daughters are producing at a remarkable rate.

Testing has been continued under Register of Merit conditions. Five records have been completed that average 7,503 pounds of milk and 386 pounds of butterfat at an average age of 2 years 11 months. Four of these animals were visibly affected with the nasal disease.

COLUMBIA, S. C. (SANDHILL), STATION

Five years' results are now available on the grazing experiment with annual crops and permanent pasture, as shown in table 5.

TABLE 5.—*Comparative results from grazing permanent pasture and annual crops at the Columbia, S. C. (Sandhill) station. Average for 5-year period, 1933–37*

Cropping and grazing system	Cow-days of grazing	Milk yield per acre (4-per-cent fat—corrected basis)	Yield of forage per acre	
			Total digestible nutrients	Alfalfa-hay equivalent
Annual crops:	*Number*	*Pounds*	*Pounds*	*Pounds*
Winter	99	1,392	665	1,322
Spring	114	2,655	1,214	2,414
Total	213	4,047	1,879	3,736
Permanent pasture	152	[1] 1,994	1,254	2,492

[1] Dry cows were used for part of the grazing.

The annual-crop phase of the experiment includes plantings of a mixture of oats, rye, barley, and vetch for the winter-spring grazing, and of soybeans interplanted with pearl millet for summer grazing. Other crops have been tried in an attempt to extend spring and late summer grazing periods. The permanent pasture consists of Bermuda grass and lespedeza in the upland areas with considerable carpet grass, lespedeza, white Dutch clover, and hop clover in the lower areas.

The permanent pasture on the average produced only 71 percent as many cow-days of grazing and 67 percent as much total digestible nutrients per acre as the annual crops. In alfalfa-hay equivalent, the permanent pasture produced at the rate of 1.3 tons per acre as compared to 1.9 for the annual crops. The additional cost of frequent preparation of seedbeds, of seed, and of the more frequent applications of fertilizer for the annual crops, will have to be considered in comparison with the upkeep of the permanent pasture, as well as the relative yields of the forage on the two types of grazing, in order to determine which is the more profitable.

In 1932 a small area in the permanent pasture was planted to Japanese lawngrass (*Zoysia japonica*). A very satisfactory sod has developed and it is now possible to measure the carrying capacity with dairy cattle. For 1937 a total of 187 cow-days of grazing per acre was obtained with a production of 2,774 pounds of 4-percent fat-corrected milk per acre. The total digestible nutrients produced, as calculated from the requirements for maintenance and milk yield of the cows grazing the plot, amounted to 2,264 pounds per acre or an alfalfa-hay equivalent of 4,501 pounds per acre. This is considerably more than was produced by the annual crops or by the permanent pasture grazed in

1937. The Japanese lawngrass is not so palatable as the other pasture grasses and cows have to be restricted to this grass in order to get them to eat it.

Fourteen calves have been dropped to the services of Saugerties Royal Sequel 159031, the proved Guernsey sire now heading the herd. Four of these calves (two males and two females) died of hemorrhagic septicemia during the past year. Saugerties Royal Sequel now has 19 tested daughters in the herd in which he was proved that average 15,758 pounds of milk and 823 of butterfat, on a mature-equivalent basis. Three of these daughters hold world records in their particular age classes. Fifteen of the daughters out of tested dams average 14,172 pounds of milk and 811 of butterfat (mature equivalent) as compared to an average of 13,958 pounds of milk and 774 of butterfat for the respective dams. He appears to possess the hereditary factors for a very high level of production. He is the third sire of known transmitting ability to be used in this herd.

LEWISBURG, TENN., STATION

The experiment that was started in 1933 to extend the grazing season by seeding crimson clover on permanent pasture sod has been continued, and a series of plots has been laid out and fenced in order to determine more accurately the resulting increase in carrying capacity of the pastures. The methods of grazing, time of seeding, and other factors are being studied. The seeding of other crops on pasture sod for early spring grazing or for hay or silage has been tried out experimentally, and the results appear most favorable for this method of economically increasing pasturage and roughage crops. Hairy vetch made a particularly fine growth on pasture-grass sod.

Twelve cows were shipped to the Jeanerette station. Fourteen additional females were sold during the year because they were unsound or were non-breeders and to make room for the increase of the herd.

In the heifer-feeding experiment that has been in progress for 5 years, three groups of heifers were fed after 1 year of age as follows: Group 1 received machine-dried roughage ad libitum, but no grain; group 2 received machine-dried roughage limited to 10 pounds, plus 2 pounds of grain per day; and group 3 received 8 pounds of machine-dried roughage, plus 3 pounds of grain per day. All groups had abundant pasture and no grain during the summer months. The data show that if Jersey heifers are up to standard weight at 12 months of age they will make satisfactory growth when given unlimited quantity of a good quality machine-dried legume hay during the winter and abundant pasture during the summer. Of their total yearly gains, from 65 to 70 percent was made during the summer (7 months) pasture season and 30 percent was made during the 5-month winter-feeding period.

HANNIBAL, MO., STATION (THE HATCH FARM)

Four Jersey cows in the roughage feeding experiment have completed lactation periods when fed on roughage alone, viz., alfalfa hay and silage and pasture with no grain. On a mature-equivalent basis they averaged 8,663 pounds of milk and 423 of butterfat for an average lactation period of 341 days. The same cows, on official test in earlier lactations when they were fed liberal grain rations in addition to hay, silage, and pasture, averaged 12,644 pounds of milk and 648 of butterfat. On roughage alone they produced 69 percent as much milk and 65 percent as much butterfat as they did under full-feed conditions. These four cows have all calved again and are being continued on roughage alone for second lactations.

Peggy's Majestic Duke 259690 has sired 36 daughters in the breeding herd, 25 of which are still in the herd. He is being retired from service until more information is obtained on the producing ability of his daughters in this herd. His first five daughters to freshen in this herd, averaged 8,438 pounds of milk and 492 of butterfat (mature-equivalent basis). Four of these daughters out of tested dams averaged 8,484 pounds of milk and 507 of butterfat as compared to an average of 12,193 pounds of milk and 658 of butterfat for the four respective dams. When this sire was selected in 1933 to head the breeding herd he had six daughters that had completed records in dairy herd-improvement associations, which averaged 581 pounds of butterfat as compared to an average of 474 for their six dams.

Progress Owl's Pilgrim 319668, the sire that succeeded Peggy's Majestic Duke, now has 11 daughters in the herd, all under 1 year of age.

Practically all of the cropping land (27 acres) on the station farm is now seeded to alfalfa. Preparation and seeding costs on one field of 14 acres seeded this past year amounted to $26.95 per acre. The cost of preparing the seedbed amounted to $7.52 per acre and the cost of hauling and spreading lime and commercial fertilizer, and the cost of the seed, amounted to $19.43.

Twenty-seven tons of green rye and barley were purchased and ensiled. The total cost, including hauling 6 miles, amounted to $5.56 per ton. The quality of the silage was very good. Forty-one tons of green corn were purchased, hauled 2 miles, and placed in the silo at a total cost of $4.18 per ton. The green corn was purchased for $2.75 per ton as compared to $1.75 per ton for the rye and barley.

COOPERATIVE WORK WITH THE WASHINGTON EXPERIMENT STATION

An experiment has been completed, and the data prepared for publication, in which three groups of 10 cows each were kept 3 years on the following rations: (1) Pasturage during the pasture season, and hay made from pasture herbage during the balance of the year; (2) pasturage during the pasture season, and silage made from pasture herbage and from oats and peas during the balance of the year; (3) pasturage during the pasture season and both hay and silage during the balance of the year. No grain was fed.

The average daily production of 4-percent fat-corrected milk for the total experimental period was 19.8 pounds for the cows receiving pasture and hay, 19.4 for the cows receiving pasture and silage, and 19.8 for the cows receiving pasture, hay, and silage. On the average the cows milked 306 days of each year.

Fifteen of the thirty cows also had 41 lactation records that were made on rations containing grain. These cows produced an average of 76 percent as much milk and 72.5 percent as much butterfat on the all-roughage rations as they did on the rations containing grain.

The calcium and inorganic phosphorus content of the blood serum remained within normal variations, except that for one winter the cows on hay alone averaged lower for inorganic phosphorus. There were no symptoms of phosphorus deficiency during the course of the experiment.

The pasture on which these cows ran for an average of 185 days each year was very good, averaging 1.5 cows per acre. During the pasture season the cows obtained 88 percent of their total nutrients from pasturage. Hay or silage supplements were fed only at the beginning and the end of the pasture season.

The total digestible nutrient consumption of the cows on silage alone, during the winter feeding period, was only 86 percent of that of the cows on hay alone.

COOPERATIVE WORK WITH THE UTAH EXPERIMENT STATION

In the 4 planes of feeding experiment 12 cows have been fed through 4 lactation periods on 4 different rations. The cows were fed through one lactation period on a grain mixture consisting of barley 2 parts, oats 1 part, and wheat bran 1 part, fed at the rate of 1 pound to each 4.33 pounds of milk produced, together with alfalfa hay, and corn silage, and/or pasture; through a second lactation they were fed only alfalfa hay and pasturage during the pasture season; through a third lactation they were fed ground barley as the sole grain ration, at the rate of 1 pound to each 6.03 pounds of milk produced, in addition to alfalfa hay, and/or pasturage during the pasture season; and during a fourth lactation they were fed alfalfa hay and corn silage and/or pasturage during the pasture season. On the alfalfa hay and pasture ration these cows produced 69.75 percent as much milk and 65.77 percent as much butterfat as when they were on the mixed-grain ration; on the barley ration they produced 86.03 percent as much milk and 89.24 percent as much butterfat; and on the alfalfa hay, corn silage ration they produced 73.57 percent as much milk and 69.93 percent as much butterfat.

On the basis of average yields for the crops fed in these experiments, on different classes of soils in Utah, the acreage required to grow crops for the alfalfa hay and pasture ration was only 66 percent as much as that required to grow the crops for the mixed-grain ration; the acreage required to grow crops for the alfalfa hay, silage, and pasture ration was only 68 percent as much; and the acreage required to grow the crops for the barley, alfalfa hay, and pasture ration was only 85 to 88 percent as much.

The yields of milk and butterfat and their value per acre were practically the same for the mixed-grain ration and for the alfalfa hay and pasture ration; the yields and values were 91 to 95 percent as great for the barley, alfalfa hay, and pasture ration as for the mixed-grain ration, and they were the greatest for the alfalfa hay, corn silage, pasture ration.

DIVISION OF NUTRITION AND PHYSIOLOGY

E. B. MEIGS, *in charge*

CAROTENE REQUIRED FOR PRODUCTION OF NORMAL CALVES

Sixteen calvings, for which the carotene content of the diet of the cows was known, have occurred in the nutrition herd during the last 5 years. All the cows were free from infectious abortion, and the results of these calvings are shown in table 6.

TABLE 6.—*The quantity of carotene required in the cow's ration to furnish the vitamin A needed for the production of normal calves*

Cow No.[1]	Hay fed		Daily intake per cow			Calving results
	Kind	Carotene content per kilogram [2]	Hay	Total carotene	Carotene per kilogram of body weight	
		Milligrams	*Kilograms*	*Milligrams*	*Micrograms*	
1	Clover	23.1	5.7	132	250	Strong heifer calf, survived.
2	Timothy	21.0	5.2	116	252	Do.
3	do	17.8	6.0	107	191	Strong bull calf.
4	do	18.2	5.5	100	260	Strong bull calf, weight at birth 45 pounds.
5	do	19.8	4.8	95	202	Strong heifer calf, survived.
1	Clover	18.0	5.0	90	161	Appeared normal at birth, weight 54 pounds, lost in epidemic of scours.
6	do	17.9	4.8	86	195	Strong heifer calf, weight at birth 35 pounds.
7	do	19.4	4.3	83	224	Slightly weak at birth, weight 48 pounds, died in scour epidemic, no serum used.
8	Timothy	20.5	4.0	82	178	Slightly weak heifer, survived.
5	do	17.0	3.6	61	121	Slightly weak bull calf, weight 47 pounds, given serum for scours; alive July 11, 1938.
	do	9.6	5.9	57	142	Calf breathed and died at once at birth.
	do	14.3	3.7	53	156	Strong heifer calf survived.[3]
1	Clover	11.0	4.6	51	104	Weak bull calf, stood third day, died eighth day after birth.
9	Timothy	10.7	4.7	50	140	Female, born dead.
10	Clover	11.0	2.8	31	70	Very weak heifer, cod-liver oil given it, survived.

[1] All cows were either Jerseys or grade Jerseys, except No. 3, a Holstein-Friesian.
[2] Determined without adsorption filtration.
[3] Cow was on pasture until about 7 months before she calved.

It appears that the cows in this experiment required 86 milligrams or more of carotene daily to produce strong and normal calves; that when the mother's daily carotene intake was 61 to 86 milligrams the calves were slightly weak but might survive; and that when the cows received less than this quantity the calves were very weak or dead at birth, unless the mother had previously had access to feeds high in carotene, such as pasture.

With the above data, and the carotene content of various grades of alfalfa and timothy hays, as given in last year's report, one should be able to select market hays that would supply an adequate amount of carotene for normal calving.

CARROTS AS SUPPLEMENT TO POOR-QUALITY HAY

Experimental cows on U. S. No. 3 timothy hay and grain have invariably produced calves that were abnormal at birth. This difficulty has been corrected by supplementing the ration with cod-liver oil, which contains both vitamins A and D. Experiments have also been conducted to determine whether carrots, which are rich in carotene (vitamin A) but do not contain appreciable amounts of vitamin D, would be as effective as cod-liver oil in correcting this difficulty in reproduction. On the carrot ration the cows received 5 pounds of carrots daily when not milking and 20 when milking. On the cod-liver oil ration all but two cows received 20 milliliters of oil daily, the two exceptions receiving 50 milliliters daily. There were 15 calvings by cows on the carrot rations; 12 calves were apparently normal at birth, 2 were carried full term but were born dead, and 1 was an abortion. The same cow that aborted bore one of the dead calves at another calving. With the cod-liver oil supplement, there have been 10 calvings; 6 calves were normal at birth, 3 were abortions (2 by the same cow), and 1 calf died during delivery.

Of the 12 normal calves produced by cows on the carrot ration, 3 died of infectious scours and 1 died at 67 days of age of an undetermined cause. These four deaths, however, may not have been related in any way to the diet of the mother. It is obvious that both the carrots and cod-liver oil were decidedly helpful in supplementing the deficiency that caused the cows on the poor-quality hay and grain ration to produce abnormal calves. The cod-liver-oil supplement, however, was no more beneficial than the carrots, thus indicating that a deficiency of vitamin A and not a deficiency of vitamin D was involved in this particular reproductive failure. Poor-quality hays, however, frequently contain more vitamin D than similar hays of better grade, and also the animals in this experiment were allowed to run outdoors in a dry lot daily.

MINERALS IN CATTLE FEEDING

An experiment is now in progress to compare the rates of growth of cattle on a low-calcium, timothy hay and grain ration, with and without bonemeal, when the possibility of a vitamin A or vitamin D deficiency is guarded against by feeding 20 milliliters of cod-liver oil daily. The timothy hay used was U. S. No. 1. Most of it contained 0.25 to 0.30 percent of calcium, although some had as much as 0.35 percent. The hay and grain were fed in approximately equal proportions. The grain mixture consisted of wheat bran, 20 percent; corn meal, 30; linseed meal, 25; and soybean oil meal, 25 percent.

The calves have been started on the experiment in pairs at 6 months of age and fed to 18 months of age, one of each pair receiving the basal ration and the other the basal ration supplemented with either 3 or 6 percent of bonemeal. Four pairs have either completed or practically completed this period. When 3 percent of bonemeal was used, the weight gains for two calves on the supplemented ration were 90 and 97 percent, respectively, of those on the basal ration. When 6 percent of bonemeal was used the weight gains of two calves on the supplemented ration were 99.5 and 90 percent, respectively, of those on the basal ration. There is, therefore, no beneficial effect on growth as a result of adding the bonemeal to this low-calcium timothy hay ration. These results agree with those obtained in other laboratories.

RAISING CALVES ON SKIM MILK AND POOR-QUALITY HAY

It is quite general practice now in this Division to rear calves without the use of whole milk after they receive their mothers' colostrum for 3 days, and to feed them skim milk supplemented with cod-liver oil (10 or 20 milliliters) in place of the whole milk usually fed, the skim-milk feeding being continued for 6 months. Six heifers raised in this way have now reached milking age. Five of these received 20 milliliters of cod-liver oil daily for only 2 to 4 months, of which four were weaned onto a ration of grain and No. 1 alfalfa hay and one onto a ration of grain, carrots, and No. 3 timothy hay. The sixth calf received the 20 milliliters of cod-liver oil throughout the experiment and was weaned onto a ration of grain and No. 3 timothy hay. Six additional heifers of younger ages are now being reared like this last calf, along with seven others that receive this same ration supplemented with bonemeal.

When the energy intake has been adequate during the first few weeks on this feeding regime, no disadvantages have been observed in its use. The question,

however, arose as to whether it is necessary to use cod-liver oil or whether, instead, a supplement supplying only vitamin A would be adequate.

When, in testing out this question, the calves were fed a ration of grain and No. 3 timothy hay supplemented with 15 milligrams of carotene in oil daily, some of the animals were observed during the early milk-feeding period to stand frequently with their backs in an arched position; and two calves that had access to the same grain-hay ration, and that early received a small amount of whole milk but no supplements containing either vitamins A or D, suffered paralysis of their rear legs as a result of injury to the spinal cord due to a crushing of some of the vertebrae. These results suggested that it might be necessary to supply in addition to vitamin A some factor affecting calcium assimilation with rations of skim milk when the animals are being weaned onto grain and No. 3 timothy hay, or possibly subsequently with this grain-hay ration. The evidence pointing to the possibility that vitamin D might be deficient in these rations is in part offset by the fact that the condition associated with the arched back occurred in an animal exposed to light, and with another animal was speedily relieved by replacing the No. 3 timothy hay with No. 1 alfalfa, which might be expected to contain possibly somewhat less vitamin D than the timothy, but, on the other hand, to be consumed in somewhat greater quantity. Also, in an early experiment that bears on the question as to the necessity of supplying vitamin D as a supplement to such rations, three animals on a ration of grain and No. 3 timothy hay supplemented with carotene had grown as well as their pair mates receiving cod-liver oil in place of the carotene.

To determine more definitely whether calves reared, as above described, may suffer from a deficiency of vitamin D as well as vitamin A during the skim-milk feeding period, and whether or not this deficiency may continue after the animals begin to eat considerable quantities of the No. 3 timothy hay, an experiment was started in which skim milk was fed to all of the calves up to 6 months of age and the animals were weaned onto a ration of grain and No. 3 timothy supplemented in the following ways: Group 1, 15 milliliters of carotene daily, animals kept in the dark; group 2, 15 milliliters of carotene plus viosterol daily, animals kept in the dark; group 3, 15 milliliters of carotene daily, animals allowed outdoors; group 4, 45 milliliters of carotene daily, animals kept in the dark; group 5, 45 milliliters of carotene daily, animals allowed outdoors; and group 6, 20 milliliters of cod-liver oil daily, animals allowed outdoors.

These groups are kept on this experiment until 12 months of age. They are then slaughtered, and in some cases the weights and ash of their dried fat-free humeri are determined. With three corresponding animals in each of groups 2, 4, and 5 that have completed this experiment, the averages for the weights of the fat-free, dry right humeri were 657, 675, and 650 grams, respectively, and the average weights of the ash of these bones were 59.9, 59.5, and 59.1 percent, respectively, of the average bone weights. These figures, as well as some data from group 3, indicate no deficiency in the calcification of the bones of these animals. These results, however, do not exclude the possibility that such deficiency may have occurred earlier in the lives of these animals. From the incomplete data now at hand, it appears that the gains in body weight during the first 6 months frequently are not as good in group 1 as in the other groups, that this retardation of growth may be overcome by the use of viosterol or cod-liver oil or normal exposure to light, and that it does not occur during the second 6 months, when more hay is eaten, even though the calcium consumption at this time is reduced as the result of omitting the skim milk. The results are consonant with the view that the skim milk itself supplies an inadequate amount of vitamin D, that the No. 3 timothy hay may readily supply an adequate amount of this vitamin, but that during the early milk-feeding period some calves may be somewhat restricted in growth as a result of vitamin D deficiency before they begin to eat a sufficient amount of this hay. This occurs, however, only with calves that are not allowed out of doors and normally such difficulties are not likely to be encountered.

THE CAROTENE (VITAMIN A) CONTENT OF ROUGHAGES

In 1935 evidence was presented to show that carotene extracts from hays and silages, that are prepared for analysis by modifications of the Willstätter and Stoll procedure, contain pigments other than carotene. This evidence was based on the spectral absorption of these fractions. A year ago this evidence was further confirmed by a study of the adsorptive properties of these carotene

fractions. A method for the determination of carotene in cattle feeds, based on the use of an absorption column, has been worked out but is not entirely satisfactory as yet and further work is being done along this line. As was predicted last year, the adsorption technique gives results for the carotene in hays and silages that are 10 to 40 percent lower than those obtained by the various modifications of the Willstätter and Stoll procedure that are now in general use in various laboratories. A report on the carotene content of market hays and corn silage has been prepared for publication, which includes a critical consideration of methods used to determine the carotene in cattle feeds.

The carotene content of silage frequently appears to be greater than that of the material from which the silage was made. In previous work in this Division the average difference between the plant and the silage from nine lots of corn was 37 percent; but an investigation of the carotene content of corn silage, using the adsorption technique, indicates that on an average 30 percent of the pigment ordinarily read as carotene is actually not carotene. Further work to determine the actual changes in carotene content during the making and preservation of corn silage was started with the ensiling of the 1937 corn crop.

RELATION OF ROUGHAGES TO MUSCULAR DYSTROPHY

Roughages at one time were regarded as necessary in the diet, particularly as a source of indigestible material. While this may be an important function, roughages are now known to be important sources of minerals and vitamins; and it is certain that investigators still do not know all about the function of roughages.

Work with goats (Cornell) indicates that muscular dystrophy may develop in these animals when roughages are omitted from their diet, even though the diet contains no cod-liver oil to provoke this condition. Work previously reported from this Division indicates that when rabbits are fed cod-liver oil their resistance to its toxic effect depends largely on the character of the roughage in their diet. When rabbits are fed U. S. No. 1 alfalfa hay, their resistance to the development of muscular dystrophy (as a result of feeding cod-liver oil) is much greater than when U. S. No. 3 alfalfa hay is used.

During the present year much of the No. 3 alfalfa fed to rabbits has contained small amounts that retained much of its green color; and the rabbits showed resistance to the development of muscular dystrophy until the hay was fed ground so that they could not select the portions they preferred to eat. It has been found that the material in No. 1 alfalfa hay that tends to prevent muscular dystrophy on diets containing cod-liver oil can be extracted from the hay with ethanol. Three rabbits fed the ethanol-treated hay, along with grain and cod-liver oil, have now ceased to grow and one of them is paralyzed as a result of muscle dystrophy. No. 1 alfalfa hays that have been subjected to extraction with ethyl ether and with petroleum ether are now being tried, and the extracts are also being fed to test out their capacity to prevent this dystrophy.

As previously reported, wheat-germ oil in the diet of rabbits on a grain, cod-liver oil, and poor-quality hay ration counteracts the toxicity of the cod-liver oil: but it has now been found that it will not cure the sterility produced by a ration of U. S. No. 1 timothy hay and grain. Wheat-germ oil was without effect when added to the diet of 10 rabbits that had failed to reproduce on this hay and grain ration. The relation of roughages to the production of muscular dystrophy and to reproduction (see 1937 report) is complicated and little understood, and it should be pointed out that this failure of wheat-germ oil to cure the reproductive difficulty of these rabbits is of very limited significance.

ERRORS IN DETERMINING THE VITAMIN A VALUE OF BUTTERFAT

To determine spectrophotometrically the vitamin A value of butterfat, it is necessary to estimate the carotene and the vitamin A itself separately. Attempts have been made to calculate the vitamin A potency of butter in this way and to compare the result with that determined biologically. In general, the calculated and biologically determined values have not agreed well.

The difficulty with the spectrophotometric method of determining the colorless vitamin A in butterfat, by saponifying and reading the absorption of the nonsaponifiable fraction at a wave length of 328 mμ, has been considered in

previous reports. The spectral absorption curve for this fraction, when read in ultraviolet light, does not resemble that of vitamin A even when corrected for carotene. This is particularly true at shorter wave lengths than 328 mμ. In previous reports evidence has been presented to show that some of the materials affecting this spectral absorption curve practically do not absorb light at wave length 328 mμ, but this evidence is not entirely satisfactory and more work needs to be done on this problem.

It appears that the spectrophotometric method of determining the carotene in butterfat, although probably more accurate and more satisfactory than that for determining vitamin A itself, is also subject to considerable error. When melted butterfat is examined spectrophotometrically, it appears that the ratios between its absorptions at wave lengths of 430, 450, and 480 mμ cannot be accounted for solely by a mixture of beta-carotene and ordinary leaf xanthophyll in the butterfat, at least with the sample of leaf xanthophyll used; and when this butterfat is melted, the nonsaponifiable fraction appears to contain on an average about 20 percent less carotene when read in ligroin at wave length 450 mμ than would be calculated from the absorption of the melted fat at wave length 436 mμ. This difference has been quite variable. At the same time the soap layer contains a small amount of pigment even when the volume of the water used in separating it from the nonsaponifiable fraction is as much as six times the volume of the methanol used in the saponification. This small amount of pigmet in the soap layer would not, therefore, seem to be either carotene or xanthophyll; and when some of it was separated off in fractionation of the soap layer in one case, this fraction had not the spectral absorptive properties of either of these pigments; but, on the contrary, it varied in color with the pH value of the medium in which this fraction was dissolved. Further evidence of the complexity of the mixture of pigments in butter was obtained by adsorption filtration of the nonsaponifiable fraction, as described elsewhere in this report. Several pigmented layers were observed in addition to the carotene. These results indicate that possibly the discrepancy between the vitamin A potency of butter as determined biologically and spectrophotometrically is due largely to errors in the spectrophotometric method involving both the carotene and the vitamin A itself.

In the above work, alpha-carotene was found in the butterfat of cows that were being fed carrots.

THE COMPOSITION OF FATS

Work was done in an effort to develop a method that might be used in the study of the composition of fats, which is being made with Bankhead-Jones funds in this Division and in the Division of Research Laboratories. Through the standard methods of saponifying fats and of separating the liberated fatty acids, much information has been obtained; but, nevertheless, little progress has been made in the identification and study of the glycerides that actually exist in the unsaponified fats, and, in addition, satisfactory methods are still lacking for the study of some of the unsaturated fatty acids.

With the use of ascaridole and light as catalysts, the addition of thioglycollic and thioacetic acids to points of unsaturation of fats and fatty acids has been found to proceed somewhat completely; and the glyceride derivatives thus formed are for the most part readily soluble in alcohol and thus separable from the unchanged glycerides of the saturated acids. Thus saturated glycerides may be precipitated from a solution of butterfat in alcohol, after treatment with thioglycollic acid. One of these saturated glycerides has been isolated in what may be fairly pure form. It appears to be one of the three glycerides derivable from stearic, palmitic, and myristic acids. The addition of thioacetic acid also occurs quite readily; and, upon saponification, mercapto derivatives of the unsaturated fatty acids are formed. These seem likely to be useful in the identification of unsaturated acids. For instance, with butter a solid ester (melting point 82° C.) of a mercaptostearic acid has been obtained which presumably is the 10 mercaptostearic acid which would be derived from the oleic acid in the butter.

Some preliminary efforts to isolate derivatives of the addition products of the glycerides of the unsaturated fatty acids have not as yet been successful; but it is quite obvious that the reactions being studied may yield methods that may be very useful for the study of the composition of fats, although the original fat constituents are not obtainable from the derivatives used in the separation and identification.

NUTRITIONAL TESTS WITH SMALL ANIMALS

On a grain mixture consisting of wheat bran 30 percent; corn meal, 40; soybean oil meal, 20; and linseed meal, 10 percent, rats can be maintained quite successfully at least for eight generations if this mixture is supplemented with yeast, cod-liver oil, and the Osborne and Mendel salt mixture; but, if U. S. No. 1 alfalfa hay is substituted for these supplements there is difficulty in reproduction and the rearing of young, and eventually (seventh generation) complete failure in these respects. Failure is even more precipitant (second generation) if the alfalfa is incorporated as a meal in the grain mixture.

Rabbits, however, do very well on the above grain mixture (fifth generation), both in reproduction and lactation, when the ration is supplemented with a good grade of alfalfa hay; but fail eventually (third generation) in these respects when a poor grade of alfalfa hay is used. Milk feeding improved the ration containing the good-quality alfalfa; and there is some, but less certain, evidence of increased fecundity and improved lactation when shark-liver oil is added to the ration of the green and poorer quality hay. Experiments are now in progress to test out the effect of milk and other supplements on growth, fecundity, and lactation when added to the poor-quality hay and grain ration.

Work previously reported indicates that corn silage when recently made from good green corn and fed to rats as a source of water-soluble vitamins, is a good supplement for the deficiencies in this respect in corn meal. Corn silage that had been stored in the silo for 2 years has now been similarly tested. It still contains considerable of these water-soluble vitamins that supplement those in the corn meal.

PHYSIOLOGY OF REPRODUCTION AND MILK SECRETION

In the study of the physiology of reproduction, in cooperation with the Bureau of Animal Industry during the year, work was continued (1) on the preparation of androgenic material—i. e., material having the physiological action of the male sex hormone—from bull urine, (2) on methods of estimating this material, (3) on the quantities of it in the urines of individual bulls, and (4) on its chemical nature and on the synthesis of androgenic hormones.

The urines of about one-third of the bulls examined to date in the herds at Beltsville have contained androgenic material, but in much lower concentration than was found elsewhere in human urines. It appears to be chemically an —enone and at least to this extent to resemble testosterone, the male hormone that up to the present time has been identified only in the testes of cattle. During the year a method of assaying quantitatively one two-hundredths of an international unit of androgen has been put into practice in this laboratory. The technique takes advantage of the much greater sensitivity of the capon comb to the direct application of the hormone.

The action of the synthetic androgen, testosterone propionate, has been tested out on a yearling steer. Fairly large quantities of this hormone were found to stimulate the seminal vesicles slightly and to have a definite influence on the cytology of the anterior pituitary. Several hundred castrated and normal male rats used in a quantitative study of this androgen have confirmed the finding of other laboratories that it will correct the castration changes in the sex accessories and anterior pituitary in the male rat. The weights of certain sex accessories are directly proportional to the amount of hormone injected.

To date, the anterior lobes from more than 100 cows and 50 bulls have been prepared for histological examination. Much of this material has been analyzed cytologically. This work is being supplemented by bio-assay of some of these glands for the several pituitary hormones.

Differing from all other mammals where a careful analysis has been made, prepubertally castrated male cattle show a decrease in activity of the basophilic cells. Also, contrary to other animals, there is no increase in the number of these cells. The basophilic cells that became inactive as a result of castration have been partially restored cytologically in one steer by the injection of rather large doses of synthetic androgen. The freemartin anterior lobe usually has been found to be typical of castration. However, in one intersex, that had especially well developed sex accessories, the basophilic cells were not so inactive as the others. This animal and the injected steer are probably examples of threshold doses of gonadal hormones.

In two nymphomaniacs, the basophiles were hyperactive. In a cow that had been thyroidectomized and ovariectomized, two types of basophiles were dis-

tinguished. The irregularly shaped sparsely granular cell typical of the basophile in other mammals becomes very large and vacuolated while a granular spherical basophile, intensely stainable with phosphomolybdic acid haematoxylin, becomes smaller and less active with an increase in stored material, and the acidophiles show extensive degranulation. The anterior pituitaries from six cows that were exceptionally deficient in milk production had large areas of inactive degranulated acidophiles and more than the usual number of active basophiles.

The influence of vitamin A deficiency on the anterior pituitary has been investigated in the case of two steers maintained on a ration very low in vitamin A, for 10 and 12 months, respectively. Both showed at autopsy an accumulation of a fairly large amount of a watery fluid between the posterior and anterior lobes of the pituitary gland. This fluid was under tension and had brought about pressure atrophy in the anterior lobe.

DIVISION OF DAIRY RESEARCH LABORATORIES

L. A. Rogers, *in charge*

CHEMISTRY AND BACTERIOLOGY OF MILK

The need for additional information on the nutritive value of milk fat has made it necessary to come back to some of the unsolved problems of the chemistry of butterfat. Consequently, work on the separation of some of the fatty acids has been increased, through funds from the Bankhead-Jones appropriation. Some of these acids have never been separated and the existence of at least one of them is a matter of dispute. The greater part of the work consists in contriving and testing methods. This is very slow work but some progress is being made.

A paper on the buffer action of calcium citrate was published and work was commenced to determine the solubility of calcium citrate under various conditions. This information should be of general scientific interest, especially in work on dairy products in which crystals of calcium citrate sometimes form.

An investigation into the causes and controlling factors of the oxidized or metallic flavor of milk was brought to a stage at which certain definite conclusions can be made and the results prepared for publication. The data, which are now very extensive, show that contrary to generally accepted theories this flavor of milk is not due to enzymatic action but to an oxidation which takes place only when certain conditions in the milk are favorable. The most important factor in causing milk to acquire an oxidized flavor is the presence of an inorganic catalyzer, of which copper salts are the best example.

There is no evidence to indicate that any particular feed is directly connected with the occurrence of the flavor except that it is much more likely to occur in milk from cows on dry feed. However, the tendency to produce milk that will become oxidized does not necessarily disappear when cows are put on green feed. In some cows this tendency is so fixed that it persists even under the most favorable pasture conditions.

Two methods of control are available to a milk distributor. One is scrupulous care in avoiding any contamination from metals, particularly copper, at all stages in handling milk. Under some circumstances the general condition of the herd milk may be improved by eliminating the milk of certain cows and a method has been proposed by which these milks can be detected simply and with considerable accuracy.

This defect of milk is more widespread than is commonly supposed, and it is probable that a larger proportion of the milk is affected in the winter months.

An investigation on sensitizing resistant spores to heat by first exposing them to ultraviolet rays was completed and the results were prepared for publication. This work was started with the hope that some way would be found to sensitize these spores to heat so that they could be destroyed at a comparatively low temperature. It was found that when spores were given a preliminary exposure to ultraviolet rays, particularly those in the Schumann region (1,250 to 1,600 Å), they are destroyed by a shorter exposure to heat than those not so treated but the difference is not great enough to be of practical value. Preliminary exposure to heat does not make the spores more susceptible to the killing effect of ultraviolet rays.

The possibility of stimulating germination in these resistant spores to the stage in which they would be sensitive to heat, and thus could be destroyed

by a comparatively low temperature, offers a more promising field for further study and some encouraging results have been obtained. Before actual growth begins there is a change in the cellular structure of the spores and they become as sensitive to heat as vegetative cells. If all spores could be induced to assume this form, sterilization would be a simple matter.

Among the amino acids one has been found that has a distinct stimulating effect on the germination of spores when it is added to the medium in very small quantities.

By certain variations in temperature spores, at least those of some species, can be induced to pass from the resistant to the heat-sensitive stage and this change can be brought about under conditions which will not permit the growth of vegetative cells.

Preliminary work has been done on a series of experiments involving the spectroscopic analysis of spores and vegetative cells. This method will make it possible to determine accurately the chemical composition of different spore-bearing species and may reveal interesting and significant correlations between the chemical constitution and heat resistance of bacterial spores.

An investigation into certain phases of mastitis, particularly its effect on the physical and chemical properties of milk, is practically completed and the results are being prepared for publication. This investigation, which is being conducted in cooperation with the Division of Nutrition and Physiology, has extended over a number of years and has involved the detailed examination of quarter samples of milk from a large number of cows, in some cases for several lactation periods. This work has consisted of frequent examinations, starting at the beginning of the first lactation when the cows were normal and continuing through the mastitis condition, either when the disease developed naturally or when it was induced by means of the milking machine.

The accumulated data make it possible to trace what may be considered the normal development of the infection. In some cows, before any significant evidence of bacterial invasion appears, there are indications of an inflammatory condition in the udder, particularly an increase in leucocytes and chlorides in the milk. In other cows, typical mastiditis streptococci are present for considerable time before other significant changes occur in the milk, or before a definite infection of the udder takes place. More or less coincident with a chlorides content of over 0.12 percent there occurs a marked increase in the numbers of leucocytes and infecting organisms, and a marked loss in the rennet-coagulation property of the milk. As the disease progresses to its peak the pH value of the milk is markedly changed and there is further loss in rennet coagulatability. Following the peak of the disease the numbers of infecting organisms and the percentage of chlorides are reduced, but there is a continued abnormality in pH value and in number of leucocytes until a marked trend toward recovery is evident.

These changes may be induced, almost at will, by increasing the severity of machine milking; that is, by increasing the vacuum and extending the time of operation of the machine. The inference may be drawn that one of the conditions essential to the development of mastitis is an injury to the udder that eventually lowers the resistance until the invasion of the udder tissue by bacteria is possible. If this assumption is correct, it should be possible to produce typical mastitis by inoculation when the resistance of the animal is reduced by severe machine milking or other treatment which injures the udder tissue. Attempts to induce mastitis when the udder has not been injured usually fail.

The increase in chlorides in the milk may be taken as evidence of an injury to the udder tissue which permits the infiltration of blood serum into the milk.

Observations on the germicidal property of milk from udder quarters affected by mastitis show that the strength of the germicidal property varies with the quarter and that it tends to be correlated with the number of leucocytes. This germicidal property increases with the severity of the infection until a general break-down in resistance occurs, after which it becomes greatly reduced. Blood serum also is bactericidal and if added to the milk of the cow from which the blood serum is derived it increases to some extent the germicidal action of the milk. However, if the blood serum has no bactericidal action its addition to milk greatly decreases the normal activity of the milk. It is easy to see that under some circumstances the infiltration of blood serum into the milk would seriously deplete the forces with which the animal resists bacterial invasion.

BUTTER AND BYPRODUCTS

An investigation of the influence of various types of neutralizers on the keeping quality of butter has been completed, but since the data have not yet been completely tabulated no final conclusions can be drawn.

There is evidence that the best results are obtained with magnesium hydroxide and that there is an advantage in holding the cream in contact with the neutralizer for 24 hours before churning. The keeping quality of butter made from cream pasteurized and ripened with a lactic starter can be improved by reducing the acidity with a mild neutralizer.

An attempt has been made to predict the keeping quality of butter by measurement of the amount of peroxides and its resistance to bleaching. This has been largely a study of methods, and while a number of promising ones have been developed none is considered entirely satisfactory.

A photoelectric colorimeter for rapid and accurate measurement of color changes has been constructed but proved to be not sufficiently sensitive to give the accuracy required. This is being remodeled to obviate the defects in the first instrument.

The loss of butterfat in the buttermilk obtained by churning sweet pasteurized cream, while small on a percentage basis, is large enough in the aggregate to be of some importance. Attempts to recover this fat by mixing the sweet buttermilk with whole milk and separating and by the addition of pectin and separating have failed to reduce the butterfat much below 0.3 percent and in no case was it appreciably below the loss occurring when the untreated buttermilk was separated.

An investigation is being made of a method of inhibiting the growth of bacteria in hand-separator cream while it is held on the farm. The results obtained are promising but in consideration of the complexity of this problem it is unsafe to make any definite statement until the investigation can be extended to cover a greater variety of conditions than are available in the laboratory.

Research on the casein-fiber project has been continued in an effort to increase the strength and water resistance of the fibers without sacrificing flexibility. The influence of a large number of substances has been tested and several have been found satisfactory and practical in use. Nine applications for public-service patents covering most of the important features of this work have been filed. Research on this project has been discontinued, but will be resumed when the patent situation has been clarified and commercial developments point the direction in which further investigation is needed.

Work was started under a Bankhead-Jones grant on the conversion of lactic acid to acrylic acid or acrylate esters. Although only one man was available for 6 months some progress was made.

The process of separating the various constitutents of whey by extraction with alcohol, previously conducted only on a laboratory basis, was tested on a semi-plant scale with improvised equipment available in the laboratory. This test was so successful that equipment was ordered which when assembled will permit a complete operation on a pilot-plant scale. The process consists essentially in the extraction of whey powder or concentrated whey with hot alcohol of a definite concentration. The insoluble residue removed by filtration consists of water soluble protein-rich material, practically free from lactose and exhibiting excellent whipping properties.

On standing, 80 percent of the theoretical yield of lactose separates from the alcohol, giving a high-grade product with one crystallization. By varying the concentration of the alcohol, a somewhat smaller yield of lactose is obtained but it is a mixture of 1.3 parts of the beta form and 1 part of the alpha form, which is readily soluble in water and correspondingly sweeter than the ordinary alpha form. On evaporation of the alcohol, a third product is obtained which includes the salts, some lactose, and riboflavin in a concentration, on a solids basis, 5 to 10 times that of the original whey powder. In a properly constructed plant this process will be conducted almost entirely in a closed system and practically all of the alcohol will be recovered.

The possible uses of these products are still to be developed, but it is very evident that the riboflavin can be used profitably as a constituent of poultry feeds. The whipping properties of the protein-rich fraction will probably be valuable in certain food products and in confections, but the use of the lactose is problematical.

Continued work on possible uses of whey solids in foods has developed a long list of foods and confections in which the peculiar properties of whey serve a useful purpose. In some of these the unit cost for materials is reduced; in others the physical properties are improved, and in all of them the nutritive value is distinctly increased.

Some preliminary work on dried soups, in which about 25 percent of the solids content is derived from whey, indicates that a very satisfactory product can be made. Pea and bean soups lend themselves readily to this treatment but other vegetables present certain mechanical difficulties in drying and the keeping quality is still to be determined.

Since the last report emphasis has been placed upon development of specific formulas for different types of whey candy. The types of candy for which formulas have been prepared, together with the approximate percentage content of whey solids are as follows: Brittle Wheyfers, 40; taffy, 20; caramel, 26; fudge, 21, and whipped fudge, 14.

Many variations in candy formulas are possible. It seems probable, however, that the formulas for the use of whey in candy as developed will give the average candy maker enough information to enable him to start manufacturing whey candy. There is no doubt but that whey can be satisfactorily used in candy, but the extent of its use will be determined by economic considerations.

Whey can be used in candy to replace part of the milk solids, sugar, and corn sirup normally used. It can be substituted for these ingredients at the same cost or at a lower cost, and in addition it would increase the nutritive value of the candy, produce a mildly sweet candy, and eliminate the danger of the development of hard casein curds during the boiling of candy mixtures, which sometimes occurs when poor skim milk is used.

ICE CREAM

A long investigation, completed during the year, has reduced the relation of temperature to overrun in ice cream to a mathematical formula and shown that whipping capacity as thus measured is a fundamental, reproducible property of any mix. The results are of a highly technical nature but offer some applications which should simplify and further standardize ice-cream making. They indicate that the time wasted by the common practice of freezing and whipping back, with the refrigerant cut off, may be avoided by adjusting the freezing so that the desired temperature and overrun will be reached simultaneously.

It has been previously considered that the effects of aging are due for the most part to the setting of the gelatin in the ice-cream mix. This work has demonstrated that the presence of gelatin is not necessary for the aging process to effect a marked improvement in the whipping capacity and stability of an ice-cream mix. The effects of aging are also found not to be apparent unless the mix has been heated in the process of manufacture, as during pasteurization. Homogenization is not necessary, but does augment the effects of aging. It seems safe to say that heating produces some changes in the normal mix that the physical properties of the mix change slowly upon standing at a low temperature. The changes during aging are fundamentally associated with the milk constituents other than fat.

It has long been known that mixes made with butter as the source of milk solids not fat whip poorly. Actually a butter mix may have an overrun at a given temperature 25 percent lower than the normal mix made with cream.

Normal whipping properties can be restored to the mix if the butter is first made into cream by homogenizing the butter with skim milk and using this cream as normal cream is used in preparing the mix.

Increased whipping properties over normal can be had if the cream is made from diluted skim milk. Mixes made from butter in this manner whip much more rapidly than mixes made from normal cream.

CHEESE

In the commercial manufacture of Swiss cheese there is a marked variation in the composition of the cheeses, not only between neighboring factories, but in the same factory from day to day and even between kettles on the same day. This is due, in part, to the fact that the cheeses cannot be sampled for analysis without injury and the cheese maker has no way of ascertaining the composition of his cheeses until they are ready for cutting. An attempt was made to obtain this information by calculations based on the composition of

the milk and the losses of milk solids in the whey, but a year's trial in the field proved that this was not dependable. A new method has been developed which, by an analysis of the curd as it is dipped from the kettle, gives a very close approximation to the composition of the green cheese. While this information is not available until the cheese is made, it enables the cheese maker to adjust his standardization and manufacturing methods to obtain cheeses that are fairly uniform in moisture and fat content from day to day.

Up to the present time the difficulty of controlling the composition and other factors affecting the quality of the cheese has prevented an accurate estimate of the effect of variations in water or fat content on eye formation, flavor, and texture of the cheese. A study was made of the factors controlling the water content of Swiss cheese, and it was found that, by a combination of variables in the manufacture, the water content may be controlled within certain rather narrow limits. Experimental work made possible by this control has indicated that the quality of cheese is affected unfavorably when the water content is raised above what may be considered normal limits and the data collected by the field laboratories support the laboratory findings.

Preliminary work on the relation of the fat content to texture, eye formation, and flavor showed that comparatively small variations in the fat content have a decided influence on the quality, but the data collected are not yet sufficient to warrant definite conclusions.

It is reasonable to assume that if the milk used for making Swiss cheese could be pasteurized, the bacteriological conditions could be controlled and a more uniform grade of cheese could be obtained; but all attempts to make Swiss cheese in this way have been, at best, only partly successful. This problem was revived and a number of cheeses were made at Beltsville from pasteurized milk. While some of these cheeses were of good quality, there was a tendency for the pasteurized-milk cheeses to retain too much water. They did not respond to the usual measures for drying the curd in the making process, and it is evident that new methods will have to be devised for moisture control before uniform results can be obtained.

An investigation of the effect of using milk from cows affected with mastitis was completed. This work has shown the effect of mastitis on the physical properties of the milk, especially its reaction with rennet. It has also shown that the deleterious effect of milk from mastitis-affected cows may be overcome, at least in large measure, by clarification. Incidentally, this work has shown that the beneficial effect of clarification, which has been known for a long time, is due to the removal of leucocytes and other cellular material from the milk.

In the 2 years that the mobile laboratories have been in operation in the Swiss-cheese districts of Ohio and Wisconsin, sufficient data have been accumulated to establish a definite relation between the quality of the milk as measured by the methylene blue reduction test and the grade of the cheese. These data show that as the reduction time of the kettle milk increases there is a corresponding decrease in the proportion of undergrade cheese, and that the proportion of undergrades increases sharply if the milk has a reduction time of 3 hours or less. Furthermore, there is evidently a distinct correlation between the rate of acid formation in the kettle and the grade of the cheese. In making cheese from milk requiring more than 3 hours to reduce methylene blue, the chance of making a No. 1 or special grade cheese is greatly increased if the pH value at dipping is between 6.36 and 6.51. A reaction above pH 6.51 indicates a failure of the acid-forming bacteria to begin growth properly and the cheese will almost certainly be undergrade. On the other hand, an acidity at dipping below pH 6.36 shows too great activity of the acid-forming bacteria and the chances are about even that the cheese will be undergrade.

Notwithstanding the fact that Cheddar-cheese making has been established on a factory scale for a great many years and that Cheddar is by far the most important cheese made in this country, the process for manufacturing good-quality cheese has not been standardized. Moreover, information on which this could be done is still lacking. There is no criterion on which a standard of milk quality can be based, no dependable rule for the development of acid, no exact limitations on water content, and no established relationship between these factors and the temperature at which the cheese should be ripened to obtain the required flavor.

Experimental cheeses have been made over a period of 2 years in order to collect data on these factors, and while the data are not yet in a form for complete tabulation, some very definite trends have been established. This will not include the influence of the quality of the milk, because this could not be determined under laboratory conditions.

There is also some question as to how far the results obtained in the laboratory will apply to factory conditions which involve a milk supply quite different from that available in the laboratory.

A trailer laboratory has been fully equipped for bacteriological and chemical work and established at a factory in Wisconsin in cooperation with the University of Wisconsin. In this laboratory the bacteriological condition of the vat milk will be established by the methylene blue reduction test and the resazurin test, the acidity of the milk and curd at various stages of the making process recorded, and chemical analysis made of the finished cheese. Sample cheese of milk from each vat will be stored for grading after 3 months and 6 months of storage. It is expected that this work will supplement that done in the laboratory and that the two together will make it possible to establish standards and formulas on which a campaign to improve the quality, and particularly the uniformity, of Cheddar cheese can be based. This standardization will probably include three points: (1) A minimum bacteriological condition of the milk as measured by the methylene blue reduction time or the resazurin test. (2) A maximum and minimum limit for the acidity as measured by the pH reading or by titration at a certain stage in the manufacture, as, for instance, at milling. (3) A maximum limit on the water content of the finished cheese.

A new method, mentioned in the last annual report, for making Cheddar cheese from homogenized milk has been given an extensive laboratory test and has proved satisfactory in every way. This method differs from those previously suggested and found unsatisfactory in that instead of homogenizing the whole milk the cream only is homogenized. The homogenized cream and the skim milk are recombined, pasteurized to destroy the lipolytic enzymes, and the cheese is made by the usual process. In this way the detrimental effect of the homogenization on the casein is avoided and a normal curd is obtained. Incidentally, both the time and the power required for the homogenization are greatly reduced. Cheese made in this way ripens normally but differs from ordinary Cheddar in that when exposed to a high temperature there is only a slight exudation of fat. This method should make it possible to export natural cheese in cans to tropical and subtropical countries.

INTRODUCING NEW METHODS AND PRODUCTS

Two informal conferences were held to bring to the attention of leaders in the dairy industry and related interests the recent advances in dairy technology and new products developed in the laboratories. One of these was attended by a small group of Swiss-cheese makers for whom demonstrations were made of various means of controlling the composition and quality of Swiss cheese. A second larger group representing a wider range of interests was shown new methods for utilizing dairy byproducts. There was a gratifying amount of interest shown in the demonstrations and informal talks; and on the other hand, the laboratory men got information on factory and market conditions and many helpful suggestions for possible uses of products that have been developed in the laboratory.

The two mobile laboratories in the Swiss-cheese districts are serving a very useful purpose by demonstrating to the cheese makers the value of laboratory control in improving the quality of the cheese and especially in obtaining a more uniform product. Data collected in 2 years' work have shown very clearly the importance of controlling the quality of the milk and the rate of acid development during the manufacturing process and since these conclusions are based on cheese made in the factories they are very convincing to the cheese makers. Assistance is also given in adjusting the fat content of the milk to produce a cheese within the legal requirements and, incidentally, a better grade of cheese.

There has been an increased interest in canned Cheddar cheese and three companies are now packing cheese in cans as an established procedure. Two others are making preparations for making trial packs. The experience of these three factories supports our contention that only cheese of the best quality should be packed in cans. They have demonstrated, however, that if sufficient care is exercised in the selection of the milk and the inspection of the curd, the loss from poor quality is negligible. One of the companies that has been packing canned cheese for its own stores uses exclusively a 5-pound can containing 10 individually wrapped half-pound prints. One uses both 2-pound and 12-ounce cans intended for direct sale to the consumer.

Arrangements were made with a chain of stores operating lunch counters to make a trial pack of Swiss and Cheddar cheese in slices ready for sandwich making. The Swiss cheese will, necessarily, be ripened in the customary loaf, cut into blocks of the proper size, and machine sliced. The Cheddar cheese may be sliced and canned as it comes from the press, or it may be ripened in 5-pound prints of a convenient shape for slicing.

The concentrated sweetened whey recently developed for use in confectionery and other food products is now being made in one dairy plant for trial sale through a firm specializing in dairy products for the candy trade.

DIVISION OF MARKET-MILK INVESTIGATIONS

ERNEST KELLY, *in charge*

DAIRY SANITATION INVESTIGATIONS

The mastitis investigations, which consist of periodic examination of milk from a selected group of cows for evidence of mastitis, were continued. Analyses were made on 1,096 samples of milk from 34 cows. No detailed statistical study of the data will be made until the cows in the experiment have completed several lactation periods. Certain observations noted in last year's report, however, are supported by the new data. These observations may be briefly stated as follows: (1) There is a trend toward increased chloride content of the milk as the lactation period advances. (2) Some cows apparently with no infection consistently produce milk with a chloride content higher than that considered normal. (3) Many cows with mild udder infections produce milk with a chloride content and leucocyte count within the limits usually regarded as normal. (4) An abrupt rise in chloride content and leucocyte count in the milk of a previously normal cow, even though they remain within the so-called normal limits, strongly indicates the beginning of an infection.

The organisms associated with the epizootic of mastitis reported last year were identified as *Pseudomonas aeruginosa.* Considerable work was involved in this identification, as it included a study of the biochemical reactions of 22 strains, 18 from dairy cows and 4 known strains obtained from other laboratories. During this work it was found that previous descriptions of this organism were erroneous in regard to certain biochemical reactions, and it is believed that this study will be a distinct contribution to a clearer bacteriological description of this particular species.

Rules for using the score cards for the sanitary inspection of dairy farms and for the sanitary inspection of city milk plants have been written. They were approved by the score-card committee and by the manufacturing section of the American Dairy Science Association.

At the request of the National Bureau of Standards, farm and laboratory tests were run on a number of samples of milk filter pads that they submitted. Following the tests on these materials a test for dairy filter pads was developed and transmitted to the Bureau of Standards.

MILK-PLANT MANAGEMENT STUDIES

MILK-BOTTLE LOSSES

The study of milk-bottle losses and ways to reduce them was completed and the results were published, together with a digest of the principal State laws regarding the use and misuse of milk bottles. Usually, to protect the owners of milk bottles by State law, it is necessary to have the bottles registered by the proper State official. When the containers have been properly registered the certificate of registration is prima facie evidence of the adoption and ownership of the mark or name used on the container by the dealer, and it is unlawful for any person except the owner of such registered containers to use them in the distribution of milk without the owner's consent. Trafficking in milk bottles or other containers except with the consent of the owner is prohibited by most State laws and most States protect the owner and user of milk bottles by making it unlawful to put any unclean substance in such containers or to destroy them. In most localities the bottle exchange, as the representative of the milk dealers, is made responsible for the enforcement of the bottle laws. In a few cases they

are enforced by the State dairy departments or the State departments of health or of markets.

The failure of many consumers to return the bottles is due in a large measure to negligence and a lack of knowledge that they are of value and are the property of the milk dealer and should be returned to him either through the stores or the route salesmen. Various methods of educating consumers on this matter are discussed in the circular. The practice of charging for all bottles delivered to stores by milk dealers has been an important factor in reducing milk-bottle losses.

SINGLE-SERVICE MILK CONTAINERS

A survey was made of the use of single-service containers for milk in several eastern cities. Single-service containers are used quite extensively for delivery of milk to stores in New York, Philadelphia, and Baltimore. One distributor in a small city also uses single-service containers for delivery to family trade. This distributor was selling about 1,250 quarts to family trade and about 9,000 quarts to stores in paper containers. In New York City over 300,000 units are sold daily in paper containers, principally through the chain stores, and practically all milk handled by chain stores in Philadelphia and Baltimore is in single-service containers.

While the paper container itself costs more than glass bottles (which average approximately 30 trips) including the washing of the glass bottle, considerable economies can be effected in the delivery to stores if the entire load of the delivery truck consists of milk in paper because of the smaller space and lower weight required as compared with glass.

Although paper containers are not used to any extent for retail delivery of milk, they are used quite extensively for sale of milk through stores and their use for this type of business seems to be increasing.

MILK-PLANT EQUIPMENT IN MODERN PLANTS

A survey was made of the equipment used and methods of operation in some of the more modern milk plants in eastern cities and considerable information was obtained. The following are some of the observations that were made:

Milk-plant equipment has been greatly speeded up during the last few years, so that a greater output per man-hour is obtained than was the case a few years ago. This has been accomplished by the use of more labor-saving devices, such as conveyors, and machinery geared up to a greater speed.

Practically all plants are using a continuous system of pasteurization, the plate heat exchanger and the cabinet type of heater being the most common. Tanks or vats are the most common types of holders used. These are automatically operated. Regeneration is used in the pasteurizing process at most of the modern plants. This results in a considerable saving of steam and refrigeration. With the systems of pastuerization now commonly used a large quantity of milk can be pasteurized with a comparatively small floor space.

EFFECT OF PLANT OPERATIONS ON QUALITY OF MARKET CREAM

At the Beltsville dairy plant experiments were conducted to determine the effect of certain plant operations on the quality of bottled cream. It was found that with the coil-vat pasteurizer a good quality of cream could be produced even with the coil revolving at a speed of 60 revolutions per minute, provided the cooling of the cream is done over a separate cooler. When the cream was cooled in the vat, however, a cream plug would form on the bottled cream within 24 hours at room temperature and within 48 hours at refrigerator temperature. This tendency to form plug was more pronounced as the amount of cooling in the vat increased. When the cream was cooled to only approximately 100° F. in the vat and the remainder of the cooling done over a separate cooler, no plug resulted; but as the cream was cooled further in the vat the tendency to form a plug increased.

Further experiments were conducted in the laboratory on the effect of agitation at various temperatures. The raw cream was agitated by pouring it from one pail to another 25 times and also by agitating it in the ice-cream freezer at high speed for 2 minutes. In order to be able to set the samples at room temperature without their turning sour, a few drops of formalin was added to each bottle of cream. Greater cream-plug formation was obtained in all agitated samples as compared with the unagitated samples. Agitation at all tempera-

tures between 40° and 100° F. resulted in a tendency to plug formation, but the most critical temperatures seemed to be between 60° and 85°. At these temperatures the fat globules tend to form clusters and to churn easily. At lower temperatures the fat is in a more solid state and at temperatures above 95° the fat is melted. The practical application of these results is that milk or cream coming into the plant should always be below 50° and the milk or cream should be handled quickly and with a minimum of agitation, especially between 55° and 85°.

MILK-QUALITY-IMPROVEMENT INVESTIGATIONS

CURD TENSION OF MILK

Work has been continued and is nearing completion on the curd tension of milk and its relation to digestion.

Work with the various coagulants and methods has shown the following method of making curd-tension determinations to be satisfactory:

The coagulant, N/10 hydrochloric acid containing 0.45 percent of pepsin, is made fresh daily. Ten milliliters of coagulant (at 35° C.) is put in a 200-milliliter tall-form beaker. To the coagulant is added 100 milliliters of milk (at 35°). The milk is blown from a 100-milliliter pipette, which has the tip removed so that it drains water in approximately 4.5 seconds. The milk is blown from a pipette held vertically over center of beaker in approximately 3 seconds. The contents of the beaker are not rotated. The beaker containing the milk and coagulant is immediately placed in a water bath at 35° and kept there for 10 minutes.

In measuring the curd tension, any instrument may be used which has the American Curd-o-meter-type knife or a knife having the same design and amount of cutting surface. The instrument, however, must give an automatic movement of the knife or receptacle at a constant speed. The speed of the knife used in this work is approximately 1 inch in 7 seconds. The curd tension (in grams) is recorded as the steady value after the knife has started through the curd.

Samples are run in duplicate. If the curd tension of the duplicate samples varies more than 10 percent, the sample is retested. If the variation is 10 percent or less, the average of the two readings is reported as the curd tension for that particular sample.

RELATION OF CURD TENSION TO DIGESTION

It is impossible to measure digestion accurately in vitro because the conditions of the stomach cannot be accurately simulated. Indication of digestibility, however, can be obtained. In this work N/10 hydrochloric acid with pepsin was used as the digestant. Sufficient of this reagent is added to bring the pH value of the mixture of milk and the digestant to approximately 3.5. The mixture was held in a water bath at 37.5° C. The samples were agitated at 15-minute intervals. The amount of digestion was measured by formol titration, as this method was found much more satisfactory than titrating with alcoholic potassium hydroxide.

The results obtained indicate that soft-curd milk starts to digest more rapidly than hard-curd milk, but that it is not more completely digested at the end of a reasonable time.

Raw milk, with an average curd tension of 75 grams by the Hill method and of 46 grams by the hydrochloric acid-pepsin method, was boiled. After the milk was boiled, the average curd tension was 24 grams by the Hill method and 9.6 grams by the hydrochloric acid-pepsin method.

The digestion results of the above milks showed that the greatest increase in rate of digestion of soft-curd (boiled) over hard-curd (raw) milk was during the first 15 minutes. During this time an average of 76.5 percent more digestion took place in the soft-curd milk than in the hard-curd milk. After the first 15 minutes, the average difference in the amount of digestion which had taken place in the raw and boiled milks decreased, the differences in favor of the latter being 34.8, 25.0, 17.2, 10.3, 8.49, 1.60, and 0.40 percent at 30-minute, 45-minute, 1-, 2-, 3-, 4-, and 5-hour intervals, respectively.

Work is being done to determine whether lowering the curd tension by homogenization has the same effect on digestibility as boiling. While this work has not been completed, the work done thus far indicates that the homogenized milk is also more rapidly but not more completely digested than the original milk.

CORROSION OF METALS BY CHLORINE SOLUTIONS

An investigation was made of the corrosive effect of commonly used chlorine disinfectants on metals used in the dairy industry. The extent of corrosion was measured by weight loss. Studies were made with 100 and 200 parts per million of available chlorine on 13 metals. The procedure consisted of immersing the metal samples in milk at 145° F. for 30 minutes, then rinsing, cleaning, drying them, and then immersing them in the chlorine test solution for 30 minutes at 25° C., and finally allowing them to dry after excess liquid was removed by touching with a dry towel. This process was repeated 30 times for each strength of solution. The above procedure, with the exception of immersing in the chlorine solution, was carried out on one complete set of metals to serve as blanks. The final weight loss (or gain) was obtained by subtracting the weights of the blanks from the weight of the test pieces. The chlorine solutions were made directly from commercial chlorine disinfectants, a representative of each of three different types being used. Sodium hypochlorite, sodium hypochlorite buffered with sodium phosphate, and chloramine-T with sodium carbonate were the types used.

A summary of the corrosive effects of the various disinfectants as measured by the loss or gain in weight is given in table 7.

TABLE 7.—*Corrosive effect of various disinfectants on metals, as measured by the loss or gain in weight*

Metal tested	Relative loss or gain of weight in solutions of—					
	Sodium hypochlorite, having an available chlorine content of—		Sodium hypochlorite buffered with sodium phosphate, having an available chlorine content of—		Chloramine-T with sodium carbonate, having an available chlorine content of—	
	100 parts per million	200 parts per million	100 parts per million	200 parts per million	100 parts per million	200 parts per million
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Aluminum alloy (1.25 percent of magnesium, 0.25 percent of chromium, and 0.7 percent of silicon)	−0.4010	−1.9992	−0.6480	−1.0220	+0.0082	−0.0543
Aluminum alloy (1.25 percent of manganese)	−.3498	−1.7059	−.4723	−.4294	−.0040	−.0428
Black iron [1]						
Tin	0	−.0129	0	−.0074	0	−.0074
Stainless steel (8–18 type)	−.0007	−.0029	−.0014	−.0037	−.0018	−.0032
Nickel-chromium-iron alloy (80–12–8 ratio)	−.0010	−.0043	0	−.0037	−.0007	−.0028
Bronze	−.0123	−.0187	−.0126	−.0177	−.0164	−.0244
Nickel	+.0023	+.0042	−.0039	+.0010	−.0065	−.0023
Nickel silver [2]	−.0057	−.0104	−.0057	−.0025	−.0194	−.0196
Copper-nickel-zinc alloy (75–20–5 ratio)	−.0094	−.0103	−.0069	−.0123	−.0098	−.0164
Copper-nickel (30 percent of nickel)	−.0035	−.0098	−.0054	−.0124	−.0089	−.0165
Nickel-copper alloy (67–28 ratio)	−.0054	−.0075	−.0032	−.0054	−.0057	−.0145
Copper	−.0176	−.0210	−.0199	−.0270	−.0244	−.0454

[1] Chips of metal or scale came off all the test strips, and all results were discarded.
[2] Copper, 65 percent; nickel, 18 percent; zinc, 17 percent.

On the basis of weight loss the aluminum alloys showed the greatest corrosion of any of the metals. This was especially true with the hypochlorites; chloramine affected these metals to a definite extent only in the case of the 200-parts-per-million solution. Of the two alloys, the one containing manganese corroded to a lesser extent than the one containing magnesium, chromium, and silicon. Bronze and copper were next in extent of corrosion, copper corroding to a greater extent than bronze. For these metals the chloramine–T had a greater effect than either hypochlorite solution. The four copper-nickel alloys containing 18, 20, 30, and 67 percent of nickel exhibited some corrosion with all the test solutions, the greatest losses being with the chloramine–T. For pure tin there was no corrosion with the weak solutions but some corrosion with the 200-parts-per-million solution. The 8–18 type of stainless steel and the nickel-chromium-iron alloy showed very little corrosion. Pure nickel showed a gain in weight for the hypochlorites, with the exception of the weak strength of the buffered

solution. With chloramine–T it showed a slight loss. In the case of the black iron, chips broke off of the edges of the coating during the rubbing procedure in the experiment and results are not reported.

In all cases except nickel, nickel-silver, and one of the aluminum alloys, the weight loss or corrosion was greater for the 200- than for the 100-parts-per-million solution, although there was no constant or definite ratio between the corrosion at the two strengths. Generally the aluminum alloys were tarnished or stained to the greatest extent, with copper and bronze also showing considerable stain in several cases. The other metals did not tarnish or the tarnish was slight. An experiment was conducted to determine the effect of immersion of the test strips in the chlorine solution on the amount of available chlorine after the 30-minute immersion period. The aluminum alloys reduced the available chlorine of the hypochlorites to a considerable extent (10 to 40 percent), while the strengths of the chloramine–T solutions were practically unaffected. The other metals had practically no effect on the available chlorine.

DISSIPATION OF CHLORINE BY DIRT ON COWS' UDDERS

A check was made as to the loss of available chlorine of a solution of chloramine–T (with sodium carbonate) used in the washing of the udders of cows before milking. The strength of the solution before it was used was 312 parts per million of available chlorine, and after 5 minutes or after washing the udders of 11 cows the strength had decreased to 301 parts per million.

EDITORIAL AND INFORMATION WORK

L. S. RICHARDSON, *in charge*

During the year 11 publications were printed in the Department series, 7 of which were new and 4 were revisions of existing publications. At the end of the year 17 manuscripts were being prepared for publication. Nineteen publications were reprinted one or more times during the year and 13 manuscripts prepared in other bureaus were reviewed. Sixty-four articles written by members of the Bureau were edited for publication in dairy and agricultural journals outside the Department, and 19 publications were issued in mimeograph form for use in carrying on the Bureau's educational and service activities. Assistance was given the Radio Service in the preparation of 48 broadcasts, and 17 news releases were issued through the Department's Press Service. The Bureau also cooperated with the Office of Exhibits in preparing and revising dairy exhibits for State and interstate fairs, the National Dairy Show at Columbus, Ohio, and the Eleventh International Dairy Congress, Berlin, Germany.

PUBLICATIONS

The following articles and Department publications written by workers in the Bureau were issued during the fiscal year:

FEEDS AND NUTRITION

The carotene and color content of home-grown roughage feeds and the relation of these rations to the carotene, color, and vitamin A activity of the butterfat. Abstract. R. E. Hodgson, J. C. Knott, H. K. Murer, and R. R. Graves. Jour. Dairy Sci. 20: 427–428. (With Wash. Agr. Expt. Sta.)

The loss of carotene in hays and alfalfa meal during storage. E. A. Kane, H. G. Wiseman, and C. A. Cary. Jour. Agr. Research 55: 837–847.

The carotene requirements of dairy cattle for normal reproduction. H. T. Converse and E. B. Meigs. U. S. Bur. Dairy Indus. BDIM–826. [Mimeographed.]

The carotene content of market hays and corn silage as determined by a quantitative adsorption procedure. L. A. Shinn, H. G. Wiseman, E. A. Kane, and C. A. Cary. U. S. Bur. Dairy Indus. Unnumbered Pub. [Mimeographed.]

Feeding dairy cows on alfalfa hay alone. R. R. Graves, J. R. Dawson, D. V. Kopland, A. L. Watt, and A. G. Van Horn. U. S. Dept. Agr. Tech. Bull. 610.

Further investigations in chopping alfalfa hay at the time of storage. J. B. Shepherd and T. E. Woodward. Jour. Dairy Sci. 21: 89–96.

Experience in siloing partially cured alfalfa, methods used, losses sustained, and feeding value. Abstract. J. B. Shepherd and T. E. Woodward. U. S. Bur. Dairy Indus. BDIM–826. [Mimeographed.]

The relative value of alfalfa hay and a mixture of concentrates for milking cows. T. E. Woodward. U. S. Bur. Dairy Indus. BDIM–824. [Mimeographed.]

Methods of making silage from grasses and legumes. T. E. Woodward and J. B. Shepherd. U. S. Dept. Agr. Tech. Bull. 611.

The apparent digestibility and feeding value of apple-alfalfa silage. Abstract. J. C. Knott and R. E. Hodgson. Jour. Dairy Sci. 20: 423. (With Wash. Agr. Expt. Sta.)

The comparative nutritive value of sun cured pea vines, artificially dried pea vines, and pea vine silage. Abstract. J. C. Knott, R. E. Hodgson, and E. V. Ellington. Jour Dairy Sci. 21: 104. (With Wash. Agr. Expt. Sta.)

Stack silage. R. E. Hodgson and J. C. Knott. Wash. Agr. Expt. Sta. Bull. 348. (In cooperation.)

Making stack silage. R. E. Hodgson, J. C. Knott, and O. J. Hill. Wash. State Col. Ext. Bull. 235. (In cooperation.)

Variations between animals used in digestion experiments. R. E. Hodgson and J. C. Knott. West. Div. Amer. Dairy Sci. Assoc. Proc. Ann. Meeting 1937: 31–36. [Mimeographed.] (With Wash. Agr. Expt. Sta.)

How the dairymen can improve breeding and feeding methods. R. E. Hodgson. 1938 Ann. United Dairymen's Assoc., pp. 41, 47. (With Wash. Agr. Expt. Sta.)

Pasture investigations. A. C. Ragsdale and C. W. McIntyre. Mo. Agr. Expt. Sta. Bull. 387 (Ann. Rpt. 1936): 57. (In cooperation.)

BREEDING

Comparative conformation, anatomy, and udder characteristics of cows of certain beef and dairy breeds. W. W. Swett, F. W. Miller, R. R. Graves, W. H. Black, and G. T. Creech. Jour. Agr. Research 55: 239–287. (With Bur. Anim. Indus.)

Nature's compensation for the lost quarter of a cow's udder. W. W. Swett, C. A. Matthews, F. W. Miller, and R. R. Graves. Jour. Dairy Sci. 21: 7–11.

Nature of swelling in the cow's udder at calving time. Abstract. W. W. Swett, C. A. Matthews, and R. R. Graves. Jour. Dairy Sci. 21: 123–124.

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Breeding dairy cattle for efficient production. O. E. Reed. Amer. Jersey Cattle Club Ann. Rpt. and Proc. Ann. Meeting 1938: 71–76.

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Establishing a strain of cattle pure for high production by means of selection and continued use of proved sires. A. C. Ragsdale and C. W. McIntyre. Mo. Agr. Expt. Sta. Bull. 387 (Ann. Rpt. 1936): 56. (In cooperation.)

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HERD MANAGEMENT AND IMPROVEMENT

Tester's computer. J. F. Kendrick. U. S. Bur. Dairy Indus. Unnumbered Pub. [Multilithed.]

What can be eliminated from the tester's work to make possible newer developments. Abstract. A. B. Nystrom. Jour. Dairy Sci. 20: 490–491.

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Proving of dairy bulls systematized. A. B. Nystrom. Agr. Leaders' Digest 18 (6): 25.

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Some factors affecting the resistance of animals to mastitis. Abstract. L. A. Burkey, E. B. Meigs, G. P. Sanders, and M. Rogosa. Jour. Dairy Sci. 21: 124–125.

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Shall we use pasteurized milk? E. Kelly. Countrywoman 4 (46): 4–5.

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The relationship of mastitis milk and soft-curd milk to the manufacture of Swiss cheese. Abstract. K. J. Matheson, L. A. Burkey, G. P. Sanders, and R. R. Farrar. Jour. Dairy Sci. 21: 173.

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The manufacture of sweetened condensed whey and its use in foods. Abstract. G. A. Ramsdell and B. H. Webb. Jour. Dairy Sci. 20: 448–449.

Utilization of whey in foods. B. H. Webb. Food research 3: 233–238.

Composition of whey and of some whey products developed by the Bureau of Dairy Industry, U. S. D. A. [B. H. Webb.] U. S. Bur. Dairy Indus. BDIM–775. [Mimeographed.]

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Program of milk byproducts conference, Bureau of Dairy Industry, U. S. Department of Agriculture, April 14 and 15, 1938. U. S. Bur. Dairy Indus. Unnumbered Pub. [Mimeographed.]

MISCELLANEOUS

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Value of the dairy industry to the public. O. E. Reed. Cert. Milk. 13 (142): 5, 18, 21.

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U. S. GOVERNMENT PRINTING OFFICE: 1938

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REPORT OF THE CHIEF OF THE BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE,
Washington, D. C., September 26, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith a report of the work of the Bureau of Entomology and Plant Quarantine for the fiscal year ended June 30, 1938.

Sincerely yours,

LEE A. STRONG, *Chief.*

CONTENTS

	Page
Introduction	1
Publications and editorial work	2
Library	2
Insect pest survey and information	2
Fruit insect investigations	3
Fruitfly investigations	7
Mexico fruitfly control	8
Japanese beetle quarantine and control	9
Control of phony peach and peach mosaic diseases	15
Citrus canker eradication	16
Insects affecting forest and shade trees	16
Gypsy moth and brown-tail moth control	20
Gypsy moth and brown-tail moth quarantine enforcement	24
Dutch elm disease eradication	25
White-pine blister rust control	29
Modification of white-pine blister rust quarantine regulations	33
Cereal and forage insect investigations	33
White-fringed beetle control	38
Mormon cricket control	38
European corn borer inspection and certification	39
Black stem rust quarantine enforcement	39
Barberry eradication	39
Truck crop and garden insect investigations	42
Sweetpotato weevil control and eradication	50
Cotton insect investigations	50
Pink bollworm control	54
Thurberia weevil control	57
Bee culture	58
Investigations of insects affecting man and animals	60
Insect identification	62
Foreign parasite introduction	63
Control investigations	65
Insecticide investigations	67
Transit inspection	70
Terminal inspection of mail shipments	71
Convictions and penalties imposed for violation of the Plant Quarantine Act	71
Foreign plant quarantines	72
Certification for export	73

INTRODUCTION

Among the changes in the organization of the Bureau during the year was the creation of the position of special research assistant to the Chief of Bureau. This position was created so that more attention could be given to unifying the research work of the Bureau, and to make it more effective. P. N. Annand, Chief of the Division of Cereal and Forage Insect Investigations, was appointed to this position, his successor being C. M. Packard, in field charge of the work on the hessian fly, white grubs, and other insects at LaFayette, Ind.

The special educational and demonstrational work on control of the screwworm which was recognized as a separate field division in 1936 was discontinued on February 15, 1938. The extensive work conducted during the last 2 years in cooperation with various State agencies and individuals was believed to have made available to farmers in the areas where screwworms occur adequate information regarding methods of control. The stockmen are believed to have had ample opportunity to became fully advised as to the control of this insect, and the educational and demonstrational work was therefore turned

over to the States and other agencies to be handled in the same general manner as is the work of controlling other important pests.

During the past few years the administration of work in connection with outbreaks of the Mormon cricket and grasshoppers has been under the supervision of the Division of Cereal and Forage Insect Investigations and was directed by persons whose principal interest was research work with respect to these insects. The responsibility for the control work has interfered with the research programs because the control work occurs during the time when emphasis on research work is of greatest importance. In keeping with the organization of the Bureau's work, therefore, it was considered advisable to transfer these control activities to a division dealing exclusively with control work; therefore the control of these insects has been placed in the Division of Domestic Plant Quarantines. W. E. Dove, who was in charge of the educational and demonstrational work on screwworm control, was placed in field charge of the grasshopper-control program and established his headquarters in Minneapolis, Minn. Claude Wakeland was appointed to take field charge of the Mormon cricket work and his headquarters were established at Salt Lake City.

The death of Leon H. Worthley, for many years one of the leaders in the various pest-control activities of the Bureau, left a vacancy in connection with the Division which has the activities of controlling the Japanese beetle, eradication of the Dutch elm disease, enforcement of the gypsy moth quarantine, and European corn borer certification. This vacancy was filled by the promotion of Erle G. Brewer, assistant to Mr. Worthley, whose promotion became effective October 16, 1937.

The eradication and control of plant pests was continued under a program expanded by means of allocations of emergency relief funds. A curtailment in the general relief program resulted in reduced allotments with a corresponding reduction in the volume of work carried on under these funds. This reduction was likewise reflected in the cooperation in plant-pest control received from camps operated by the Civilian Conservation Corps.

PUBLICATIONS AND EDITORIAL WORK

During the year 520 manuscripts were presented for publication and 461 were approved, 93 being submitted to the Department for publication and the remaining 368 to outside journals. There remained on hand at the end of the year 185 manuscripts, 138 of which were under consideration in the Bureau, 40 were in the Office of Information awaiting publication by the Department, and the remaining 7 were in press at the Government Printing Office. Of the 138 in the Bureau, 82 were being considered for publication by the Department and the remaining 56 for publication in outside periodicals.

LIBRARY

The loan and reference work with books and periodicals for the Bureau staff increased over 22 percent this year.

Special bibliographies prepared to aid investigators include those on effect of radium on insects, longevity in insects, reproduction in insects, biology of *Carpocapsa pomonella*, plant-quarantine history, aims, and problems, and a brief list on toxicology. Entomology Current Literature appeared regularly bimonthly, with 156 pages as compared with 135 pages last year. The outstanding bibliographic work for the year is the Index to American Economic Entomology V, a volume of 693 pages containing some 35,000 references, compiled in the Bureau library and published by the American Association of Economic Entomologists in April 1938.

The special collection of photographs of entomologists was completely cataloged and much biographic and bibliographic information was assembled.

INSECT PEST SURVEY AND INFORMATION

The Survey added to the permanent files on the distribution and abundance of insects 14,000 notes on domestic insects and 5,000 notes on foreign insects, bringing the total now available for consultation to 278,650 notes. The work of the year added 925 species of insects to the existing record of approximately 20,000 species of American insect pests and the foreign pest file now contains over 21,000 species of insects.

The important development of the year was the increase in personnel of the Survey to a force of six professional and subprofessional workers. This group is concentrating its efforts on bringing up to date the records on insects of the world not known to be in this country, in order that there may be available in the Bureau concise information on any pest of the world that may appear in this country or may be intercepted in commerce.

The monthly Insect Pest Survey Bulletin was augmented by supplements on Alfalfa Weevil Survey, Fall of 1936; The Two Broods of Periodical Cicada Scheduled to Appear in 1937; the Species and Distribution of Grasshoppers in the 1936 Outbreak; Spread of Alfalfa Weevil in 1937; Hessian Fly Survey, Harvest-Time 1937; Liberations of Parasites of the European Corn Borer in the United States in 1937; Liberations of Japanese Beetle Parasites in the Eastern States in 1937; and Insect Notes from Costa Rica in 1936.

The value of the Survey work to the separate States is evidenced by an International News Service release, dated July 10, wherein the extension entomologist of Alabama warned through the press in his State that the cotton leaf worm was likely to appear in Alabama and other Southeastern States in the immediate future, stating that he based these conclusions on Survey reports that the insects were found in southern Texas on May 27 and in Calhoun County, Tex., on June 9.

Ninety-four articles on entomological and quarantine subjects were released to the press and 72 radio talks were put on the air. Preparation of film-strip material covered six new subjects. No new motion pictures were completed, but three important motion pictures are being made, one on grasshoppers, one on the Mormon cricket, and one on the white-fringed beetle. The Bureau participated in seven exhibits.

Cooperative extension work in entomology was supervised under the direction of the Bureau and the Office of Cooperative Extension Work.

Twelve numbers of the Bureau Monthly News Letter were issued, comprising a total of 363 pages. Publications to the number of 331,775 copies were distributed, exclusive of those sent out on regular mailing lists and miscellaneous mimeographed material.

During the year the photographic unit of the Bureau prepared 539 negatives illustrating the genitalia of May beetles of the genus *Phyllophaga*, a special project under the general direction of Philip Luginbill. For this particular work 4,850 prints were made in addition to 12,575 prints prepared for the general activities of the Bureau.

To the file of photographic prints under the custody of this division 492 new subjects were added, and 463 prints were distributed in answer to special requests from scientific workers, magazine editors, writers, students, teachers, and others.

FRUIT INSECT INVESTIGATIONS

APPLE AND PEAR INSECTS

The most striking feature of the work of the 1937 season was the very favorable results obtained in the Middle West by the use of nicotine-bentonite for the control of the codling moth. The tank-mix nicotine-bentonite developed by the Vincennes, Ind., laboratory, mentioned in last year's report, was found especially effective. A practical test of this material gave opportunity to secure data on its behavior on a schedule substantially the same as that followed with lead arsenate. It appeared equal to or better than lead arsenate in preventing worm entrance, was much better in controlling the sting type of blemish, and gave much less difficulty in residue removal. The increase in cost of the material appeared to be more than offset by the improvement in codling moth control and in the condition of the trees. A number of problems remain to be investigated further in connection with the fixed-nicotine materials. A particularly urgent need is the development of fungicides that will not interfere with the effectiveness of the nicotine combinations and yet will be safe for use on the trees.

Phenothiazine gave poorer results in the Northwest than previously, in part because it was tested at lesser strengths, and apparently in part because of an unusual rainfall of more than 2 inches that occurred in June, resulting in conditions more comparable to those existing in the Middle West and East, where the results with phenothiazine have been very disappointing.

Practical field experiments with orchard sanitation and banding gave reductions in infestation ranging from 20 to 60 percent, demonstrating conclu-

sively the value of these practices, especially under conditions of severe infestation.

Studies of methods of carrying on bait-trap experiments, conducted in southern Indiana, indicated that a great deal of the extreme tree-to-tree variation in moth captures can be smoothed out by rotating the test baits among the trees. The use of bait traps in a block of 276 trees appeared to reduce the first-brood infestation approximately 50 percent. The season's infestation, however, was reduced only about 25 percent, which indicates that the movement of moths during the summer equalized many of the differences that existed earlier in the season. In the Pacific Northwest reductions of approximately 50 percent were obtained in large-scale experiments with bait traps.

A cooperative project dealing with the control of the codling moth by mechanical methods and by the stimulation of biological control without spraying was continued in West Virginia through the season of 1937. The crop was comparatively light and the percentage of infested fruit increased from 55 percent in 1936 to 71.8 in 1937. This Bureau continued to cooperate with the Idaho Agricultural Experiment Station in the biological project at Parma, Idaho. During the season 1,085 adults of *Aenoplex carpocapsae* Cush. and 2,169 adults of *Ichneumon extensor* (Tasch.) were sent to Parma for use in this experiment.

Further experiments were carried on in cooperation with the Oregon Agricultural Experiment Station to determine the part played by the pear thrips in causing injury of the russet or scab type on prunes. Careful cage tests and experiments involving the use of windbreaks to exclude wind injury demonstrated definitely that the thrips is responsible for a typical scab on the fruit. The most important loss caused by thrips on prunes, however, consists in the prevention of the fruit from setting, and the dropping of the set fruit caused by egg laying and feeding of the thrips, which causes a partial or even complete crop failure.

PEACH INSECTS

Work with the parasites of the oriental fruit moth was continued. During 1937, eight shipments from Japan and two from Australia were received, from which were reared 38,545 adult parasites. During the season 187 releases involving a total of 39,908 parasites were made in 11 States, mostly in the Middle West, which has previously not received as many colonies as the Eastern States. The mortality of the parasites in transit averaged only 1 percent of the season's shipments to the field. Four hundred and twenty-seven recovery collections were obtained from 19 States, three-fourths of them having been furnished by cooperating agencies. In general parasitization showed a decided increase for 1937 as compared with 1936.

Experiments with the production of *Macrocentrus ancylivorus* Roh. on the strawberry leaf roller under large field cages indicated that this method of production is practical. Field studies were made to determine the capacity of various parasites for increase and spread during the season in which they are released in orchards.

Recovery collections again indicate that *Macrocentrus ancylivorus* was the most abundant and widely distributed parasite species in most of the areas. *Glypta rufiscutellaris* Cress. ranked second from the standpoint of distribution, and third in abundance; *Dioctes molestae* Uchida was in third and second places respectively. Other species showing wide distribution and reared in considerable numbers were *M. delicatus* Cress., *M. instabilis* Mues., and *Pristomerus ocellatus* Cush.

Investigations dealing with the use of ethylene dichloride emulsion and other materials for peach borer control were broadened in the fall of 1937 and spring of 1938 to include informal cooperative experiments in southern Illinois and western New York in comparison with similar experiments in Georgia. In all these experiments the results with ethylene dichloride were outstanding, both as to borer control and safety for use on trees. A further advantage lies in the fact that ethylene dichloride is effective at much lower soil temperatures than is paradichlorobenzene in crystal form or as an emulsion in cottonseed oil. This greatly increases the length of the season for fall treatments in the Northern States.

Barium fluosilicate and cryolite were tested in parts of the spray program and gave plum curculio control not significantly different from that obtained by the use of the standard lead arsenate schedule. Unfortunately both these fluorine compounds caused serious injury to the fruit. Curculio control resulting from the use of a full schedule of derris powder was considerably inferior to that obtained from the use of lead arsenate.

The survey method of approach to the study of the possible relation of insects to the transmission of the phony peach disease and the peach mosaic disease was continued. Two trailer laboratories are in operation and are covering the territory in which these two diseases occur. Each trailer laboratory traveled more than 10,000 miles during the season of 1937. In connection with the survey work, a fixed laboratory was established at Brownwood, Tex., in cooperation with the Bureau of Plant Industry, for work in the incrimination, in the transmission of the peach mosaic disease, of certain insects which were determined as suspects in the survey work.

GRAPE INSECTS

Phenothiazine was given further testing against the grape berry moth, and was again found to have outstanding insecticidal properties for this purpose. When used alone it was found to have very poor wetting properties; with a small quantity of sodium lauryl sulphate it was wet much more readily but the deposit was removed to some extent by rains. Nicotine-bentonite and nicotine-oil in the second brood, following calcium arsenate in the first, gave effective control of the berry moth, but caused a somewhat objectionable staining of the fruit.

Cooperative tests with growers continued to show that an important reduction in the spring brood of the berry moth may be obtained by a method of spring cultivation of vineyards which keeps the cocoons buried until after the normal time of emergence of the adult moths. This method appears to be most successful in the lighter soil types.

Further cooperative experiments with blast-burning equipment, designed by the Bureau of Agricultural Engineering, to test the possibility of controlling leafhoppers in hibernation areas close to vineyards again resulted in greatly decreased numbers of the adult hoppers in the vineyards in the spring.

NUT INSECTS

Attention was given at Albany, Ga., to the biology of the hickory shuckworm to obtain a better basis for further investigations on the control of the insect as a pest of pecan. During 1937 the hickory shuckworm passed through three generations and a partial fourth. The pupation of larvae from the overwintering generation extended through the entire season of 1937, the last moth emerging on December 28. About 20 percent of the individuals that hibernated as larvae in the winter of 1936–37 did not transform during 1937.

Preliminary investigations were conducted at Albany to determine whether *Macrocentrus ancylivorus* and *Ascogaster quadridentatus* Wesm., both of them important parasites of the oriental fruit moth and the latter of special importance as a codling moth parasite, would attack the closely related hickory shuckworm. Efforts to cause *M. ancylivorus* to attack the mature shuckworm larvae were unsuccessful. The results with *A. quadridentatus* were also negative. A considerable number of parasites of the shuckworm and other pecan insects were reared, adding to the accumulation of information on this subject.

Studies carried on in central Texas resulted in the development of a simple method of timing the spray applications for the nut casebearer, thus permitting control with one application where previously two were desirable. The results of the experiments in central Texas with both lead arsenate and nicotine sulphate with oil confirmed those of previous years' experiments.

At the new cooperative laboratory at Monticello, Fla., nicotine sprays of various kinds gave considerable control of the nut casebearer, the greatest reduction resulting from the use of nicotine-bentonite with summer oil in two applications. In Florida dormant applications of tar-oil emulsions resulted in the killing of 96 percent of the hibernating larvae. This material, however, caused moderate injury to the foliage on the early developing varieties, the buds of which had begun to swell at the time the spraying was done.

Results of experiments with the use of oil sprays for the control of the obscure scale confirmed results secured in previous years, indicating that dormant applications of oil emulsions at strengths of 2, 3, or 4 percent give satisfactory control. The delayed effect of oil sprays on the obscure scale, reported a year ago, was evident again in 1937. The laboratory at Shreveport, La., where this work has been carried on, was closed and the personnel and equipment transferred to Brownwood, Tex.

A new laboratory was opened at Eugene, Oreg., in August 1937 for a study of certain insect problems that are affecting the development of the filbert industry in the Pacific Northwest. A study of the filberts being delivered to the drying houses revealed the fact that worm infestation, presumably by the Catalina cherry moth (*Melissopus latiferreanus* (Wlsm.)), exists in a large number of widely distributed filbert orchards located from western Washington through western Oregon practically to the California line.

DRIED-FRUIT INSECTS

As last year, the Fresno, Calif., laboratory cooperated informally with the Marketing Division of the Agricultural Adjustment Administration, the Extension Service of the University of California, and the Dried Fruit Association of California in a large-scale demonstration of the effectiveness of shade-cloth protection of drying peaches. This involved the use of 20,000 linear yards of cotton cloth, which was used by 82 growers in 14 different counties. The use of the cloth under commercial drying-yard conditions resulted in a reduction in infestation from an average of about 45 to approximately 9 percent.

Preliminary experiments were carried on with the use of low temperatures for the control of various insects infesting dried fruits. Consideration must also be given to the effect of the cold-temperature treatments on the product.

SUBTROPICAL FRUIT INSECTS

The work to determine the effect of tartar emetic on citrus trees, in cooperation with the Bureau of Plant Industry, was completed. During two seasons with more than the usual rainfall, and one with less than normal, no effect on the foliage, fruit, or trees was observed, and no significant changes in the populations of scale insects and whiteflies were noted in the course of the experiments.

Definite progress was made toward a standardized laboratory procedure for handling the so-called resistant California red scale before, during, and after fumigation experiments, mentioned in the last report. Marking the individual scales treated helped greatly in the work. The condition and type of the host lemons and the density of the scale population seem to be the important factors as yet uncontrolled. Population counts indicated that a winter season with temperatures low enough to necessitate orchard heating will not reduce the scale population enough to permit the omission of even one fumigation.

The investigations of thrips control on oranges was completed. Cooperative experiments carried on near Phoenix, Ariz., indicated that a three-application sulphur-dusting program, properly timed, will give satisfactory control of the citrus thrips on oranges in that area. In lemon groves in the coastal area of California, where the thrips population was very high, the usual sulphur-dusting programs for oranges gave control early in the season, but by late in the summer the thrips population had built up to a high enough point to permit serious damage. Materials other than sulphur were also tested. Observations made in an orange grove at Redlands, Calif., showed that the plot dusted with sulphur for 2 years is for all practical purposes free of black scale, whereas the undusted area in the same grove is not commercially clean.

Preliminary work was done in California looking toward the development of the use of added toxicants with oils for the control of the California red scale. Butyl phthallate was found to be a satisfactory solvent for petroleum oils and certain organic toxicants. Preliminary tests were carried on with various petroleum and vegetable oils in combination with nicotine and with rotenone.

In Florida heavy infestations of scale insects developed on trees and fruits where materials containing hydrated lime and other substances leaving heavy residues were applied. The trees receiving the larger quantities of adhesive materials developed higher scale populations.

JAPANESE AND ASIATIC BEETLES

The area of continuous infestation occupied by the Japanese beetle increased approximately 2,500 square miles over the area of 2 years previous. In the older infested areas, however, the beetles were less abundant and caused less injury than in 1936. Severe injury occurred over an area that included northeastern Maryland and northern Delaware, eastern Pennsylvania, north-central New Jersey, and the New York City metropolitan area.

The influence of particle fineness on the effectiveness of lead arsenate in controlling the Japanese beetle was studied under laboratory conditions. With

the adult beetles, the more finely divided materials appeared slightly more effective but the difference was not great. For control of the larvae or grubs in the soil, more finely divided lead arsenates were somewhat more effective than coarser materials. The addition of gum arabic or lauryl sulphate to the sprays improved their immediate effectiveness and facilitated the washing of the residues from the grass into the soil.

Preliminary results with ground derris indicated that the more finely divided materials may prove more effective than the coarser ones as repellents for the adult Japanese beetle. Results with various materials intended to inhibit decomposition of the active ingredients of derris by sunlight failed to reveal any satisfactory material for this purpose. The work on the decomposition of rotenone, as measured by chemical means, indicated that some constituent of derris other than rotenone may be an important factor in its repellent effect.

Work with parasites of the Japanese beetle was continued as in previous years. During the spring of 1938, 315 colonies of *Tiphia vernalis* Roh. were liberated. Most of these were placed in Maryland as an aid in the Japanese beetle-retardation campaign which is being carried on by the Maryland State authorities. Of 352 colonies of this parasite liberated during the period 1926 to 1934, inclusive, recoveries have now been made at 224 locations. One colony which was studied in detail showed that the average parasitization of the Japanese beetle grubs has been 36 percent. A type strain of *T. popilliavora* Roh. established at 50 percent of the points at which releases were made from 1921 to 1934 does not appear to be increasing rapidly, presumably because of the incomplete synchronization of the egg-laying period of the adult parasite with the third-stage Japanese beetle grubs necessary for its normal development. A Korean strain of this species appears later in the season and is expected to become more effective. Nine colonies of the Korean form were released in Delaware, Maryland, New Jersey, and Pennsylvania. The numbers of a Yokohama strain of the same species, which is likewise better synchronized with its host, are being increased in the insectary in preparation for liberation next year.

Work with the various disease organisms that attack the Japanese beetle in the grub stage was continued. Studies of the so-called milky diseases indicated that field plots may be successfully infected by a number of different methods. A marked reduction in beetle emergence was apparent in all the plots treated with the milky disease organisms, regardless of the method of application. Positive evidence was obtained that the parasite *Tiphia vernalis* plays a part in the dissemination of the milky disease, and indications were obtained that adult Japanese beetles may disseminate the disease organisms. Experiments indicated that the infective spores in diseased larvae consumed by chickens passed through the digestive tract of the chickens without loss of vitality, adding further evidence to the supposition that birds may play a part in the distribution of the milky disease. Spores of both A and B types of the milky disease remained viable for 25 months in soil stored under a number of different conditions from which Japanese beetle larvae were excluded. In the plot started in 1935 at West Chester, Pa., diseased larvae also were recovered in scattered diggings made several miles from the original plots.

In cooperation with the Division of Cereal and Forage Insect Investigations of this Bureau and with the Bureau of Plant Industry, detailed studies were made of the susceptibility of 51 varieties of sweet corn and field corn to attack by the Japanese beetle. Seed was furnished by the agricultural experiment stations of Connecticut, Illinois, Indiana, and Iowa. Although significant differences in sterility, resulting from the feeding of the beetles on the silk, were found among the various strains, no associations between these differences and the beetle populations appeared evident. Two varieties of soybeans in the same area were both attacked vigorously, approximately 60 to 70 percent of the foliage which appeared during the beetle-feeding season being severely injured or destroyed.

FRUITFLY INVESTIGATIONS

Studies in Hawaii with the melon fly showed that an exposure of 15 days at 35° F. results in complete mortality even where high larval populations are involved. This indicates a slightly greater resistance to low temperatures than with the Mediterranean fruitfly, corresponding mortalities for that species apparently being obtained at 36°.

Data accumulated in Mexico with the vapor-heat process have made it possible to reduce the exposure time to 6 hours when the approach period

is not reduced below 8 hours, a suitable approach for commercial loads. In Mexico, also, an analytical method for tartar emetic was perfected which permits a determination of the amount and distribution of tartar emetic on leaves and fruit after spraying. This method does not require a laboratory and can be used by anyone in the field.

Protein lures first developed with fruitflies in Mexico have now proved the most efficient not only for the Mediterranean fruitfly but for fruitflies in Puerto Rico. In that island they are shown to be especially good when fruitfly populations are low, indicating that they are suitable for inspection purposes.

MEXICAN FRUITFLY CONTROL

The harvesting season of 1937–38 witnessed the highest production of citrus fruit in the Rio Grande Valley of Texas since the industry was established. The crop totalled 34,927.4 equivalent carloads. Although the harvesting season had been extended from March 31 to April 30, the packing, marketing, and processing facilities were used to capacity throughout the year so that the crop might be moved within the time limits prescribed under Quarantine No. 64.

INFESTATIONS

In the spring of 1937 a heavier infestation of the Mexican fruitfly than usual developed in the area covered by Quarantine No. 64. It was expected that if the flies that emerged as a result of this infestation remained within the area there would be a similar condition in the spring of 1938. By midsummer of 1937, however, the traps disclosed that the fly population was no higher than usual. Traps operated throughout the year indicated that the fly movement was normal during the entire season. Few flies were trapped before January, and at no time after the first of the year was the population as high as in the preceding season.

Larval infestations were found on 218 premises. These infestations occurred during the months of February through the early part of May, the peak being reached late in March. This is the second highest number of infestations for one season on record, but for comparison purposes it should be remembered that the harvesting period was extended 30 days over last year and as much as 60 days over some former years.

Table 1 shows the number of flies trapped, the number of larval infestations, and the date of close of the harvesting season for the fiscal years 1934–38.

TABLE 1.—*Infestations of the Mexican fruitfly in Texas*

Fiscal year	Flies trapped	Larval infestations	Harvesting season closed	Fiscal year	Flies trapped	Larval infestations	Harvesting season closed
	Number	*Number*			*Number*	*Number*	
1934	276	5	Apr. 5.	1937	4,714	1,062	Mar. 31.
1935	367	30	Apr. 2.	1938	[1] 712	218	Apr. 30.
1936	251	5	Mar. 31.				

[1] 79 outside of area.

STERILIZATION

Sterilization of fruit from infested groves was required throughout the season. Both high- and low-temperature methods were used. The high-temperature method proved more popular, as the time required for sterilization is only 6 hours at 110° F. at the center of the fruit. The total time necessary for sterilization, however, is approximately 20 hours. This includes the time required to bring the fruit up to 110°, the sterilization period, and the cooling period.

Sterilization at low temperatures was employed in a limited number of cases, but as it requires holding the fruit for 15 days at a temperature of 30° to 31° F., a much greater volume of fruit must be accommodated for an equal output.

Intensive inspection plus sterilization of the fruit whenever infestations are found reduces to a minimum the possibility of any infested fruit's leaving the quarantined area.

CANNING PLANTS

The citrus-canning industry continued the rapid growth noted last year. Of the total amount of grapefruit produced and harvested for shipment 45.6 percent was canned. By far the greater portion of this fruit was used for juicing purposes. This increase in the amount of grapefruit canned was brought about primarily because the fresh fruit markets could not absorb the crop as it was harvested.

No oranges were processed in the Rio Grande Valley during the season of 1937–38.

SHIPMENT OF FRUIT

Railroads, trucks, and steamers shared in the movement of citrus from Rio Grande Valley. Although production increased in excess of 4,000 equivalent carloads this season, approximately 3,350 equivalent carloads less were shipped as fresh fruit. This loss in shipments is accounted for by the reduction in production of oranges and by the increase in the amount of grapefruit processed.

Table 2 shows, in equivalent carlots, the shipments of fruit either certified for movement from this area or moved under supervision of inspectors, the amount canned, and the commercial production for the fiscal years 1933–38.

TABLE 2.—*Citrus fruit from Rio Grande Valley, Tex., shipped and canned, and total production, in equivalent carlots, fiscal years 1933–38*

Fiscal year	By rail		By truck		By boat		By express and passenger car, mixed	Canned grapefruit	Commercial production
	Grapefruit	Oranges	Grapefruit	Oranges	Grapefruit	Oranges			
	Carlots	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*
1933	2,897	230	880	586	----------	----------	101	127	4,821
1934	1,748	114	1,236	877	----------	----------	99	240	4,314
1935	4,617	225	1,731	1,095	----------	----------	239	1,131	9,038
1936	4,262	600	1,454	1,182	----------	----------	267	1,682	9,447
1937	15,616	2,729	2,578	2,351	176	17	[1] 532	[1] 6,702	30,701
1938	13,736.3	1,322.7	2,817.4	1,991.5	183.1	4.7	596.1	14,278.6	34,927.4

[1] Includes 2 cars of oranges processed.

REVISION OF QUARANTINE NO. 64

Quarantine No. 64 was revised, effective October 15, 1937, to include a portion of Jim Wells County, Tex., in the regulated area, and to fix the host-free period from May 1 to August 31 of each year.

JAPANESE BEETLE QUARANTINE AND CONTROL

TRAP SCOUTING IN NONREGULATED TERRITORY

Developments of the trap scouting of 1937 disclosed a reduction in the previously reported infestations at St. Louis and Chicago, and a scarcity of first-record infestations of an established nature.

Trap scouting for the Japanese beetle was carried on during the summer of 1937 in 415 cities and towns in 25 States, scattered from Florida to Vermont, and westward as far as Denver. There were also included a few traps operated by California authorities in Sacramento and Roseville. Approximately 111,000 traps were set, an increase of 7,500 over the previous year. Some trapping activities were conducted in all but 16 States outside the present quarantined area. The average operation period for the traps was 1 month.

Results of trapping in the nonregulated area in 1937 disclosed 31 first-record infestations, as compared with 36 the previous year. Of these, 3 were in Illinois, 3 in West Virginia, 4 in Virginia, 10 in Maryland, 7 in Ohio, and 1 each in Georgia, Indiana, Pennsylvania, and New York. Beetles were caught in 62 communities in which incipient infestations had been determined. Trapping in 322 cities and towns gave negative results.

In North Carolina beetles in varying numbers were caught in all but 2 of the 15 known infested communities in which traps were used. Beetles in considerable numbers were collected in Greensboro, Spencer, East Spencer, and Winston-Salem. There was little change in the conditions of infestation in these cities as compared with 1936.

In the South Central States trap surveys were made in Kentucky, Tennessee, Alabama, and Louisiana. In Kentucky trapping was repeated this year, 391 traps being used in Lexington and 800 in Louisville, with positive results. This year 151 traps were operated in Bristol, Tenn., with negative results, showing that the insect did not persist in the section where 4 beetles were caught in 1936. Four hundred traps were set in Chattanooga, Tenn., 398 in Knoxville, Tenn., 400 in Nashville, Tenn., 400 in Mobile, Ala., and 1,125 in New Orleans, La., all with negative results.

Traps were set in all North Central States except the Dakotas and Minnesota. The number of cities and towns surveyed in the unquarantined States were: Indiana 12, with 8,200 traps; Michigan 9, with 7,727 traps; Illinois 13, with 15,167 traps; Wisconsin 3, with 2,390 traps; Missouri 14, with 16,743 traps; and 1 each in Iowa with 400 traps, Nebraska with 398 traps, and Kansas with 780 traps. All trapping in Wisconsin, Iowa, Nebraska, and Kansas gave negative results.

There was a still further reduction in the Indianapolis infestation. Three thousand five hundred traps were used and only 12 beetles were caught during the season, whereas previous annual catches since 1934 had been 17, 57, and 28. Seven of this year's collections were caught in areas treated with lead arsenate in April 1937 and the remainder were trapped at scattered points outside. Positive results were obtained at Fort Wayne, South Bend, and Logansport, Ind., this season, 800 traps each having been used at Fort Wayne and South Bend and 300 in Logansport. Trapping was conducted in eight Indiana communities with negative results.

As a result of applications of lead arsenate to the Detroit, Mich., infestation prior to the summer of 1937, collections there were reduced from 128 to 67, with 5,045 traps in operation. In Dearborn 6 beetles were caught in 796 traps. No other infestations were determined in the State.

Control work in Chicago resulted in speedy reduction of beetles in the lead arsenate-treated area. From a city-wide total of 3,740 beetles in 1936 the combination trapping and treating program made such inroads on the beetle population that only 384 were taken this year. Approximately 10,000 traps were set out this year in Chicago, 3,000 of which were State-owned. When the heavy infestation was discovered last year near Bessemer Park in southeastern Chicago, 3,637 beetles were trapped in 72 contiguous blocks, 1 lone block accounting for 1,101 of these; 37 beetles were collected in 30 scattered blocks in the same area. Excellent control was obtained in sections treated in the fall of 1936. In the most heavily infested block in the city, trap captures were reduced from 1,101 to 2 beetles, and there was a 93.4 percent reduction from 3,674 to 242 throughout the Bessemer Park section. Intensive hand scouting was also performed in the immediate vicinity of trap finds. In the next largest infested area the reduction was from 55 to 35 beetles. Only 14 of these were found in treated blocks, the remainder having been caught outside the infested section as determined by trapping in 1936. An infestation of 23 beetles several miles south of Bessemer Park and 2 others of 29 and 38 beetles in the northern part of the city were the most important infestations found outside sections previously known to contain the beetle. Small collections of a few beetles each were made in five scattered sections in the south-central portion of the city.

Traps were likewise operated in the suburban areas of Chicago and first-record collections at Cicero and Evanston resulted. Three hundred and eighty-eight traps in Elgin, Ill., resulted in the capture of a solitary beetle for a first record. The only other collection in the State was made at East St. Louis, where 1,234 traps collected 3 beetles. A few beetles have been trapped there each year since 1934.

Freedom from infestation of 13 Missouri cities was indicated; one beetle in St. Louis was the only capture in the entire State this season, although 14,757 traps were used in St. Louis and its suburbs. In Denver and Pueblo, Colo., 398 traps, and 400 traps in Sacramento and Roseville, Calif., also failed to take beetles.

Trapping was performed in 18 West Virginia communities, 3,195 traps being set; in 9 locations results were negative. First-record trap collections were made in Harpers Ferry and at Philippi. A heavy first-record infestation covering considerable territory was observed at Hedgesville by the assistant

State entomologist, who supervised the trapping activities throughout the State. Collections indicated that beetles have persisted in negligible numbers in Charleston, Charlestown, Huntington, Martinsburg, and Princeton. At Wheeling traps showed a persistence of the beetle in slightly greater numbers.

Rather extensive trapping was done in Virginia, involving 84 communities and 5,073 traps. Catches were made in 13 cities and towns. Other than a sizeable, established, new infestation at Wakefield, the only first records uncovered were limited to small collections at three points. At the George Washington Birthplace National Monument at Wakefield a heavy but apparently localized infestation was brought to the Bureau's attention by the National Park Service. In previously discovered Virginia infestations, catches were made in Charlottesville, Pulaski, and Roanoke. Persisting small infestations were found in six other localities in the State.

Trapping in Maryland extended to 90 cities and towns, and 1,197 traps were placed. Seventy-three localities were trapped with negative results. First-record infestations were found at 10 localities. Carry-over infestations, most of them of several years' standing, were determined at seven other places. Three small infestations were discovered by nursery and greenhouse scouts in sections just outside the regulated area in Carroll and Talbot Counties.

First-record trap finds in Ohio comprise 7 locations, and isolated infestations discovered in previous years and found to have persisted include 6 locations in the eastern half of the State. In all, 15,738 traps were set out in Ohio. At Marietta, where delayed treatments of lead arsenate were applied in the spring of 1937, collections declined from 121 to 45. Of these 38 were found in the treated area and 7 in adjacent or neighboring blocks. Additional trapping in 38 other Ohio communities gave negative results.

Although nonregulated territory in New York was rather extensively surveyed with 7,154 traps, only 1 new point of collection was found, while traps were operated in 25 cities with negative results. In Rochester, Watkins Glen, Hornell, Niagara Falls, Oswego, and Watertown the infestations of previous years have persisted. In the northwestern corner of Pennsylvania outside the regulated area 4,189 traps were used in 14 towns. The collections showed that 10 towns had no infestation, while beetles were caught in 4 towns, 1 of which was a first record.

No beetles were caught in Vermont, although 400 traps were set in 25 communities throughout the nonregulated section of the State.

Arrangements were made for the operation during the summer of 1938 of a dozen traps in the vicinity of each of the 125 field stations of the Bureau throughout the United States.

Early-season trapping activities during 1938 began with the placement of traps in Fabens, Tex., on April 12. Trapping was completed before the end of the year in Mobile, Ala., Douglas and Safford, Ariz., Valdosta, Ga., Tallulah, La., Leland, Miss., and Las Cruces, N. Mex., and the five localities in Texas. At the end of the year traps were in operation in 225 cities and towns in 20 States.

Trap captures recorded during May and June 1938 included 95 beetles at Atlanta, Ga.; 18 at Louisville, Ky.; 10 at Durham, 1 at Kingston, 17 at Raleigh, 13 at Sanford, 1 at Thomasville, 38 at Wilmington, 2 at Elizabeth City, 6 at High Point, and 4 at Wilson, N. C.; 1 at Marietta, Ohio; 2 at Charleston and 5 at Greenville, S. C.; and 142 at the George Washington Birthplace National Monument at Wakefield, Va. The finds at Kingston and Thomasville, N. C., were first records; the others were survivals of previously determined infestations.

SUPPRESSIVE MEASURES

Based on the results obtained by trap scouting during the season, suppressive measures were carried out in Georgia, Illinois, Indiana, Kentucky, Michigan, Missouri, New York, Ohio, Pennsylvania, and Virginia.

Field treatments in Chicago were resumed in the fall of 1937, and 58.5 acres outside the previously treated areas received lead arsenate applications. A substantial emergency State appropriation was furnished for this work. Treatment was again begun in the spring of 1938 and continued into the next fiscal year. In addition to the soil treatment in Chicago, 19.2 acres were covered in Evanston between October 6 and 22, 1937.

In St. Louis, Mo., 2.7 acres were treated, covering the yard and surrounding premises where the one beetle was found.

In Detroit, Mich., soil treatments were made during October covering 39.7 acres of newly infested area in the city. Late in October 10.9 acres were treated in the area where beetles had been discovered in nearby Dearborn.

Infestations covering 40 acres were treated with lead arsenate in Fort Wayne, Ind., between October 12 and 27, 1937. Treatments were applied on November 1, 1937, to 0.6 acre to cover the limited area found infested outside the previously treated sections in Indianapolis. At South Bend, Ind., the treating program began April 12 and covered the 37.1 acres by April 27, 1938.

Treatment of 17.8 acres in Atlanta, Ga., was made between April 5 and 26, 1938.

In Virginia approximately 13 acres were treated at Wakefield between September 8 and 15, 1937. At Charlottesville 4 acres were treated between April 30 and May 5, 1938.

At Erie, Pa., treatment was started April 25 and completed May 23, 1938, with approximately 36 acres treated.

A soil-treating program in Rochester, N. Y., was begun April 18 and completed May 26, covering approximately 75 acres.

At Louisville, Ky., 5 acres were sprayed late in May 1938.

In Ohio 5 acres were treated at Marietta between May 16 and 21, 1938, and 7 acres at Ashtabula between May 26 and June 3, 1938.

All the soil-treating projects were sponsored by State, city, or other agencies, with the Federal Government furnishing treating equipment and men for its operation and supervision.

FEDERAL AND STATE REGULATORY MEASURES

Revised regulations were issued, effective April 11, 1938, to extend the restricted zone in Ohio, New York, West Virginia, Pennsylvania, Maryland, and Virginia. This revision added Wheeling, W. Va., and Coshocton, Ohio, to those cities which further require the certification of fruits and vegetables shipped during the period June 15 to October 15, inclusive, from other portions of the regulated zone. No restrictions, however, were placed on the movement of any fruits or vegetables from these isolated portions of the regulated area. The amendment also added Lancaster County, Pa., to the territory from which the movement of fruits and vegetables by refrigerator car or motortruck is restricted.

A supplementary revision of instructions to inspectors on the treatment of nursery products, effective December 20, 1937, authorized the fumigation of strawberry plants for Japanese beetle larvae.

A revision of the list of articles exempt from certification requirements, effective March 18, 1938, extended the list. Instructions were also issued, effective May 2, 1938, authorizing the fumigation of potatoes with methyl bromide.

Intrastate quarantines were issued by Indiana, Illinois, Pennsylvania, and West Virginia. West Virginia extended its regulated area. The other States placed under regulation the untreated, established infestations within their borders.

Incipient infestations in Georgia, Kentucky, Michigan, Missouri, and South Carolina were not of sufficient importance to justify quarantine action. The situation in North Carolina was adequately handled by continued enforcement of an intrastate quarantine extending to all important isolated infestations in the State. A North Carolina inspector devoted his time to enforcing the State regulations. Chemical treatment of isolated infestations was employed in Illinois, Michigan, Georgia, Indiana, and Kentucky.

HIGHWAY INSPECTION SERVICE

During July 1937, with road movements of quarantined products at a peak, three stations were added to those already in operation on the boundaries of the regulated area. Thirty-five roads were posted by August 1. Of these, 1 was in Maryland, 6 in Ohio, 11 in Pennsylvania, 11 in Virginia, and 6 in West Virginia. At the peak of the work 65 road inspectors were employed.

Closing of the regular stations began early in October, and rapid abandonment of the posts continued during November, with seven stations remaining open. By December all stations had been closed.

Organization of the road-patrol activities in the spring of 1938 began with the posting, during the last week in March, of five road stations to inspect southbound traffic from the Virginia regulated zone. During April, 17 additional posts were established in West Virginia, Ohio, and Pennsylvania, most of them with two inspectors each, operating 16 hours a day. This extended the road-patrol system to the most important exit highways.

When the seasonal restrictions on fruits and vegetables became operative on June 15, four additional stations were opened in Virginia. Inspection personnel was increased durng June, and full quotas of men were assigned to the posts by June 24.

At the end of the year there were in operation 36 road stations. Of this number 1 was on the Maryland-West Virginia line, 8 were in Ohio, 11 in Pennsylvania, 11 in Virginia, and 5 in West Virginia. Seven mobile inspectors were employed in Pennsylvania. Roving inspectors were also assigned to cover various highways in the vicinity of Ravenna, Ohio.

Trucks returning to southern points after driving through sections in which beetles were swarming were again found to contain large numbers of living beetles. Finds ranging from 10 to 30 beetles were common. Fifty-three lots of infested plant material were stopped at the posts, from which were removed 12 adults, 113 grubs, and 2 pupae.

Counts of all motor vehicles stopped at the road stations for inspection during the year totaled 4,661,663. Uncertified quarantined products were found in 24,848 vehicles.

CERTIFICATION AND TREATMENT OF NURSERY STOCK

Owing to increasing beetle infestations, summer scouting in 1937 in the regulated zone revealed additions to the number of nurseries and greenhouses found to be infested with the Japanese beetle. Commercial and noncommercial establishments found infested in the New England sector totaled 15, and in the New York City area 32, of which 27 establishments were located on Long Island. In the Baltimore area infestations were found on the premises of 53 nurseries and greenhouses, and within a 500-foot radius of 11 others. Additional infestations on classified establishments were found in six Virginia nurseries and one each in Delaware, Ohio, and the District of Columbia, three in Pennsylvania, and nine in New Jersey. Definite increases in beetle population were found in the Philadelphia, Pa., area, and continued through the bean-growing area of Maryland and the Eastern Shore of Virginia.

Sixty-seven nurseries, located in lightly infested sections that had been found infested with one or a few beetles in previous years, were rescouted during the summer of 1937 to determine whether they might be eligible for restoration of their uninfested status. Nine entire establishments and four out of five units of a tenth establishment were found uninfested and were restored to a preferred status of classification.

Nursery and greenhouse scouting was completed by the middle of September. Seasonal restrictions on the movements of farm products from the regulated areas were lifted on September 22, 1937.

About 987 soil samples collected from 94.9 acres of nursery plots, heeling-in areas, and frames treated with lead arsenate were analyzed by the Division of Insecticide Investigations to determine the concentration of the poison in the soil. Initial applications of lead arsenate were made to 22 acres of nursery plots and heeling-in sections.

Commercial establishments conforming to the requirements for classification increased from 2,365 to 2,514. Divided on the basis of classification, 1,837 of these establishments were in class I, 672 in class III, and 5 in intermediary classification. The number of uninfested nurseries increased by 116. There was a net decrease of 33 in the number of infested classified establishments, due to the fact that many establishments relinquished their classification when found infested.

CERTIFICATION OF FRUITS, VEGETABLES, AND CUT FLOWERS

One hundred and eighty-nine inspectors inspected fruits and vegetables during the period of adult beetle flight in 1937. Throughout the regulated area 39 inspection centers were in operation—1 each in Connecticut, the District of Columbia, Maine, and Ohio; 2 each in Massachusetts and Pennsylvania; 4 in New Jersey; 5 in Virginia; 6 in Maryland; 7 in New York; and 9 in Delaware.

Inspection of all south-bound fruits and vegetables was again centralized this season at Fredericksburg, Va., to eliminate the possibility of reinfestation of certified produce moving through the restricted region.

Imposition of stricter fumigation and loading requirements on the movement, from the heavily infested areas of New Jersey, Pennsylvania, Delaware, and

Maryland, of refrigerator cars containing fruits and vegetables resulted in the transportation of fewer living beetles in the bunkers of these cars than last year. Examination of hundreds of refrigerator cars upon their arrival at midwestern terminals from the eastern points resulted in the finding of 32 living beetles distributed among 20 cars. Nineteen of these infested cars were from the Eastern Shore of Maryland and Virginia and one was from southeastern Pennsylvania. Ninety-seven living beetles in 70 cars were found during similar terminal inspection in the summer of 1936.

Fumigation of banana refrigerator cars with hydrocyanic acid in the New York City area was started on July 6, 1937.

Requirements for the fumigation of refrigerator cars for potato shipments and for the screening of cars were lifted on September 1, 1937, since the number of beetles had decreased sufficiently at or near the vicinity of loading points. The seasonal restrictions on fruits and vegetables were removed September 21, but the restrictions on cut flowers remained in effect until October 15.

Fumigation of cars was concluded at the end of August. During the season 16,507 cars were fumigated, containing a total of 37,810 units of farm products.

Administrative instructions approved April 30, 1938, authorizing fumigation with methyl bromide of potatoes in refrigerator cars permitted fumigation of the loaded cars at Wilmington, Del., and Philadelphia, Pa., the principal diversion points. During the last half of June alone 735 carloads of such potatoes were treated under this method.

During the period of the seasonal quarantine on fruits, vegetables, and cut flowers inspectors removed adult beetles from 7,550,977 packages of commodities certified for transportation.

CERTIFICATES ISSUED, VIOLATIONS INVESTIGATED, AND PROSECUTIONS TERMINATED

To cover quarantine products moving to nonregulated territory for the year, 722,421 certificates of all types were required.

Table 3 shows the quarantined articles intended for shipment from the regulated area and for use in certified greenhouses or surface soil plots, in heeling-in areas, or in plunging areas, which were fumigated or sterilized during the 12-month period.

TABLE 3.—*Materials fumigated or sterilized under Japanese beetle quarantine regulations, fiscal year 1938*

Treatment	Plants	Potting soil	Sand		Surface soil	Surface soil with plants	Berries	Potatoes		Onions
	Number	*Cubic yards*	*Cars*	*Cubic yards*	*Square feet*	*Square feet*	*Crates*	*Cars*	*Bags*	*Cars*
Lead arsenate	252,895	20			645,437	3,509,413				
Carbon disulphide gas or emulsion	8,791	3,869	103	4,179	36,051		5,524			
Naphthalene		73			58,076					
Steam		419								
Hydrocyanic acid								26	7,704	
Paradichlorobenzene	260,630									
Methyl bromide								735		1

	Bananas		Cucumbers		Tomatoes		Peppers		
	Bunches	*Cars*	*Bushels*	*Cars*	*Cars*	*Baskets*	*Bushels*	*Hampers*	*Cars*
Hydrocyanic acid	6,625	18	4,650	11	6	4,239	1,563	2,775	5

	Onions	Eggplant	Empty cars	Peaches		Sweetpotatoes	
	Cars	*Bushels*	*Number*	*Bushels*	*Cars*	*Hampers*	*Cars*
Hydrocyanic acid	25	239	12,414	390	1	10,869	30

Nursery and ornamental stock, sand, soil, earth, peat, compost, and manure were certified for shipment from the regulated areas during the year in the following quantities:

Plants	number	29,676,383
Sand, earth, and clay	carloads	4,203
Peat	do	5
Compost and manure	do	181

Fruits, vegetables, moss, and cut flowers certified during the seasonal quarantine on these articles were as follows:

Fruits and vegetables	packages	7,462,436
Moss	bales	2
Cut flowers	packages	88,541

Apparent violations of the Japanese beetle regulations investigated by the Bureau totaled 2,436.

Convictions for transporting quarantined materials from within the heavily infested area to outside destinations without inspection and certification were secured against 18 truckers transporting farm products. Seventeen were intercepted at Rochester, N. Y., the other at Buffalo, N. Y. One corporation was fined for the misuse of Japanese beetle certificates in shipping ivy plants from New York City to Florida. One nurseryman was fined $100 for a series of violations involving the mailing of uncertified plant material. Fines were imposed by the New York State Department of Agriculture upon three truckers for intrastate quarantine violations.

COOPERATIVE ENTERPRISES

The following States in nonregulated territory provided funds or labor for cooperative control or quarantine activities: California, Colorado, Georgia, Illinois, Indiana, Kentucky, Michigan, Missouri, and North Carolina.

The city of St. Louis, Mo., also contributed funds for the trapping program. Charlottesville, Va., arranged for treatment of its infested area. A Bag the Beetle Day in Harrisburg, Pa., procured 2,000,000 beetles in 2 days during July 1937.

Cooperative control or quarantine activities in the regulated area again received State funds from Connecticut, Delaware, Maryland, Massachusetts, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Virginia, and West Virginia.

The total contributions from Federal welfare, State, and city agencies for labor and materials used to set and remove traps were approximately $32,500.

Experimental work with the nematode *Neoaplactana glaseri* in controlling established infestations of the Japanese beetle was continued at the laboratory at White Horse, N. J., under the joint cooperation of this Bureau and the New Jersey Department of Agriculture. The principal work related to the rearing of nematodes on artificial media until ingestion by the host and a new method of uniform application of the nematodes into the soil. This work was financed by an allotment of $3,000 of Federal and $9,000 of State funds.

INFORMATIONAL ACTIVITIES

In addition to sharing interest with other insect pests at four exhibits and in the September release of the March of Time, the Japanese beetle was the exclusive subject of an attractive exhibit set up at the International Flower Show, March 14–19, at the Grand Central Palace, New York City.

CONTROL OF PHONY PEACH AND PEACH MOSAIC DISEASES

The phony peach and peach mosaic projects were consolidated at the commencement of the year and field headquarters were established at Little Rock, Ark. By uniting the control operations relating to these two peach diseases, overlapping of two inspection forces was eliminated by training inspectors in both fields. Inasmuch as the diseased areas overlap in the southern midcontinent area, the union of the projects was desirable.

Inspection of nearly 10,000,000 cultivated host trees on over 88,000 properties in 21 States was carried on during the year. Trees to the number of 21,523 were found infected with phony peach disease, and 24,727 diseased trees, including some carry-overs, were destroyed. Mosaic trees to the number of 57,155 were discovered and 47,919 had been removed by the close of the year.

Inspection was conducted in Alabama, Arizona, Arkansas, California, Colorado, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maryland, Mississippi, Missouri, New Mexico, North Carolina, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, and Utah. No trees affected with phony peach or peach mosaic were found in Indiana, Maryland, or Pennsylvania. Peach mosaic was reported this year in seven additional counties, one in Colorado, four in Texas, and two in Utah.

Escaped and abandoned peach trees are dangerous harboring grounds for these diseases, and nearly 500,000 abandoned trees and over 4,000,000 escaped trees were destroyed during the year.

One of the methods of spread of these diseases is by shipments of infected nursery stock. To reduce this risk all nursery stock and, in the case of peach mosaic, all budwood sources and their environs in the infected States are inspected annually. Movement of stock is permitted by the States only when the nurseries meet the requirements of the standard State quarantines relating to these diseases.

Research has developed the fact that certain varieties of stone fruits are or may be symptomless carriers of peach mosaic. Accordingly, the plum trees in and surrounding the heavily infected area in Mesa County, Colo., were indexed with healthy peach scions. These peach grafts will act as a permanent indicator of the health of the plum trees, thereby permitting their annual inspection.

Results of inspection during the field season of 1937 showed a reduction, in number of trees infected with the phony peach disease, of 50 to 100 percent in the lightly infected States and a reduction in the generally infected States.

This project has been substantially assisted by allotments from Federal emergency relief appropriations and is carried on in close cooperation with the plant pest-control departments of the States concerned.

CITRUS CANKER ERADICATION

Inspection of citrus trees for citrus canker was carried on during the year, jointly with the States, throughout the citrus-growing areas of Louisiana and Texas, two Gulf coast counties of Alabama, and the adjacent area in western Florida. In Louisiana and Texas, the only States in which the disease is known to exist, repeated inspections were made of all areas found infected since the intensive campaign of 1935, and inspections were also extended into a number of other counties. No new areas were found infected. Canker was found recurring on 12 properties in the noncommercial areas of these States. The 103 infected trees consisted of 1-year seedlings in the case of all properties in Texas and one property in Louisiana.

One of the most important phases of citrus canker eradication consists in the removal of escaped and abandoned trees to prevent their becoming a harboring place for the disease. The success of this phase of the project was aided materially by allotments from emergency relief appropriations. In some areas in these States extensive plantings of nursery stock were set out in past years and later abandoned as an unprofitable undertaking. From these nurseries and abandoned orchards an extensive seedling spread has developed. Trees of this type, to the extent of over 2,500,000, were destroyed in the above-mentioned States during the year, to prevent their becoming a harboring place for citrus canker.

INSECTS AFFECTING FOREST AND SHADE TREES

ADVICE AND COOPERATION IN THE CONTROL OF FOREST INSECTS

The major part of the work of the Division of Forest Insect Investigations was again devoted to problems associated with the control of the various species of bark beetles which attack forest trees. Large areas of timberland were surveyed to determine the amount of insect infestation and thus obtain data upon which to base reports and recommendations as to the need for control work. On some of the larger projects entomologists were assigned to give technical advice during the execution of the control operations.

SURVEYS

Over 12,000,000 acres was covered with surveys which, in addition to serving as a basis for control work, furnished valuable technical information on the

characteristics of trees attacked by bark beetles, the relative susceptibility of various stands, and the relation between beetle outbreaks and weather. All the accumulated data thus gradually acquired should prove of much value in anticipating future outbreaks.

CONTROL WORK

The surveys showed that conditions with respect to bark beetle infestations in the ponderosa pine stands of California and Oregon were much improved as compared with recent years.

The most serious situation existed in the central Rocky Mountain region, where the period of severe drought for the past several years and the correspondingly poor tree growth encouraged activities of the Black Hills beetle and allowed this insect to build up to a new peak of abundance. The largest and most spectacular battle was waged on the Roosevelt National Forest, where over 21,000 infested trees were treated. In spite of this work there was a known infestation of 9,000 additional trees on this forest, the treatment of which was prevented by the lack of men and money. On the Medicine Bow National Forest about 10,500 infested trees were successfully treated. In the Denver Mountain Parks area a cooperative undertaking, the first of its kind, was successfully brought to a close by the treatment of 7,000 infested pines by Works Progress Administration crews, National Park Service crews, and National Forest Service crews. On the Pike National Forest over 4,000 infested trees were treated. Many other smaller projects were successfully completed throughout the region. However, some infestations still remain on private and other lands where control work is badly needed in order to prevent the destruction of many thousands of additional trees in the next few years.

CALIFORNIA HAZARD SURVEY

For several years considerable control work has been directed against the western pine beetle in the overmature stands of ponderosa pine in eastern California and Oregon. This control work has been only partially successful.

With the increased funds allotted to the Berkeley, Calif., laboratory special study was centered on ways of directing cutting operations in such a way that susceptible trees and stands can be removed and utilized before they are attacked and killed by the beetles. As a step in this direction an inventory survey based on susceptibility to beetle losses as shown by growth conditions, type, maturity, and incidence of present and past beetle infestations in the stand was started in 1937. The immediate practical application of this hazard inventory is to guide owners in early cutting of those areas where heavy losses are most likely to occur, leaving the less susceptible areas in reserve. Over 500,000 acres was classified during the 1937 season. Completion of this project will require 4 years.

NEW OUTBREAK OF THE SOUTHERN PINE BEETLE

The southern pine beetle has killed a large amount of merchantable loblolly pine, roughly estimated at around 20,000,000 board feet, in a widespread outbreak which has occurred since 1936. The area involved extends from the eastern shore of Maryland and Virginia to North Carolina. This outbreak developed following a deficit of several inches of rainfall in the spring and summer of 1936. There was also a deficit for a part of 1937 and the beetles showed a corresponding increase in numbers. Heavier rainfall has occurred in 1938 and it is hoped that the increased vigor of the trees will serve as a natural check upon the insects. There is need for considerable research work on this insect and its control.

RESEARCH ACTIVITIES

BARK BEETLE PREDATORS

The role of insects which feed upon and limit bark beetle populations is now being studied intensively, both in the field and in the laboratory. Much new information was secured concerning the two most important beetle predators, *Enoclerus lecontei* Wolcott and *Temnochila virescens* (F.), as a result of research work during the 1937 season. Experimental technique for rearing these predators under insectary control was developed.

EFFECT OF DEFICIENT PRECIPITATION ON GROWTH OF PINE TREES AND OUTBREAKS OF THE BLACK HILLS BEETLE

During the year studies on the Black Hills beetle in the Rocky Mountain region showed that there is a positive correlation between drought periods as shown by slow growth rate of the pines and outbreaks of this insect. Precipitation data were copied from United States Weather Bureau records for long periods preceding, during, and following individual outbreaks. Increment cores were taken from a large series of trees in areas where the outbreaks occurred, and the annual radial growth measured from 1915 to the present time. The data show that in the Rocky Mountain region the growth rate of pines is directly dependent on the amount of precipitation. From 1915 to 1923 precipitation averaged considerably above normal and the tree growth was correspondingly good. From 1924 to 1929 precipitation was slightly below normal and tree growth declined accordingly. From 1930 to the present time general drought conditions have prevailed, tree growth has been poor, and epidemics of the Black Hills beetle have been numerous and serious. These outbreaks have begun during periods of severe drought and relatively poor tree growth and have continued to build up to serious proportions throughout a prolonged period of similar critical conditions.

THE FOREST TENT CATERPILLAR

The forest tent caterpillar has continued to occur in outbreak numbers in various sections of the country, especially in New England and northern Minnesota. Much damage has been done to sugar maple orchards in Vermont and New Hampshire. There was a very large egg population throughout most of northern Minnesota in the winter of 1937–38, but as a result of early hatching, followed by cold weather, which delayed foliage development, mortality among the newly hatched larvae this spring was heavy.

THE PANDORA MOTH IN LODGEPOLE PINE IN COLORADO

The pandora moth, a serious pest of yellow pines in California and Oregon, was found severely defoliating an area of about 80,000 acres of lodgepole pine on the Arapaho National Forest, Colo. The lodgepole in many centers of heavy defoliation already appears doomed. Areas for survival plots have been selected in the infestation, and preliminary studies were begun last year on the life history and biology, although little is yet known about the method of control.

THE SPRUCE BUDWORM IN PONDEROSA PINE IN COLORADO

For the first time several distinct outbreaks of the spruce budworm have been found in pure stands of ponderosa pine. Preliminary studies on this apparently new biological strain of the budworm showed that it limited its activities entirely to ponderosa pine and that it not only severely reduced the growth of infested pines but also killed many laterals and terminals, and its continuance threatens the existence of the attacked trees. The biology of, and control methods for, this new forest pest are being worked out.

SCALE INSECTS

Field studies of the Prescott scale (*Matsucoccus* sp.), which attacks ponderosa pine in Arizona, have further demonstrated the connection of this insect with the killing of twigs known as "flagging." Experiments demonstrated that flags can be produced by artificially planting large numbers of scales on trees which have previously been free from this injury. Investigations with a species of *Matsucoccus* which attacks pitch pine indicate that certain enzymes secreted by the salivary glands of the insect will cause death of the tissue when injected into the twigs.

INSECTS AFFECTING PERSIMMON

Work was started in the spring of 1938 on a study of insects affecting persimmon trees. This work was necessary because of the discovery, in 1937, of a new disease of persimmon which may possibly be transmitted in some way by insects. The life histories and habits of the various insects, particularly borers, which affect persimmon are being studied in an effort to discover any possible relationship of insects with the disease.

HEMLOCK BORER

The hemlock borer has infested a large amount of the eastern hemlock which has died in parts of northern Wisconsin and the Upper Peninsula of Michigan during the last 2 or 3 years. It is believed that this insect is secondary in its action, in that it is attacking trees which are very much overmature or are weakened as the result of severe drought conditions. Work was started in 1937 to determine the part played by the borer in the deterioration of these hemlock stands.

TERMITE CONTROL

Termite investigations were conducted along two lines, (1) the inspection of commercially treated structures before and during treatment, so as to observe the practices, as well as to follow up the efficacy of the chemicals used, and (2) the treatment of buildings so as to determine more specifically the value and costs of various soil poisons which may be used under certain conditions in place of, or as a supplement to, the more desirable and permanent structural changes. Individual records were obtained concerning 185 buildings treated by 14 commercial companies and 95 buildings treated by the Bureau's personnel, 12 different chemicals or mixtures being used.

POWDER-POST BEETLES

Studies of *Lyctus* powder-post beetles indicate that hardwood lumber may possibly be made resistant to attack by modifications in seasoning practices, combined with changes in the time of year of felling. This has special significance in relation to supplying foreign markets with *Lyctus*-free timber.

AMBROSIA BEETLE DAMAGE IN FELLED TREES

As a result of heavy losses from ambrosia beetles or pinhole borers in Douglas fir-logging operations of western Oregon and Washington, studies were conducted to determine practical methods of prevention or control. The period when logs may be safely left in the woods was determined, and experiments are under way to find methods of discouraging attacks after the logs have been placed in mill ponds.

CONTROL OF CARPENTER ANTS

Considerable work was done to find effective means of controlling carpenter ants, which are so troublesome in homes of the Pacific Northwest. Several fumigants and contact insecticides gave satisfactory results, provided all the ant chambers could be reached with the chemical.

INSECT VECTORS OF THE DUTCH ELM DISEASE

The results of the collection and culture of a large number of adult elm bark beetles, *Scolytus multistriatus* Marsh. and *Hylurgopinus rufipes* (Eichh.), showed that a smaller percentage of the beetles were contaminated with the fungus organism in 1937 than in 1936. In a study of the mating habits of *S. multistriatus* it was found that the fungus may be disseminated among the beetle population as a result of physical contact of the beetles.

Elm woodpiles, slash, dead trees, and broken branches serve as very favorable breeding places for elm bark beetles. Where such material is infected with the disease the adult beetles which emerge may carry spores to healthy trees and inoculate them with the disease.

Studies made on overwintering larvae showed that the total mortality amounted to 88 percent. Death of the larvae was due to crowding, bark and wood conditions, woodpecker feeding, weather conditions, and other factors. Injury to the bark by woodpeckers in their search for larvae was found to be a good guide to bark beetle attack.

Experiments were continued to determine how to kill undesirable elms satisfactorily so that bark beetles will not breed in them. Introducing copper sulphate dissolved in water into the sap stream from May to September, inclusive, gave best results.

Observations and experiments were conducted to ascertain to what extent insects develop in elm stumps and whether such development can be prevented

by applying chemicals to the stumps. Bark beetle galleries were not common in the stumps. Attack and development of cerambycid and ambrosia beetles occurred generally both in untreated stumps and in those to which the chemicals had been applied.

GYPSY MOTH AND BROWN-TAIL MOTH CONTROL

Regular funds were supplemented by allotments from emergency appropriations totalling $1,297,011 and provided for Federal W. P. A. work on the gypsy moth in Vermont, Massachusetts, Connecticut, New York, New Jersey, and Pennsylvania. No emergency funds were made available for brown-tail moth work, and the intensive project on that insect that had been carried on during the previous 2 years was discontinued.

Of the W. P. A. funds allotted, 91.8 percent was paid in wages and more than 98 percent of all workers employed were drawn from relief rolls. The average number of workers employed during the first half year was 1,818. From January 1 to June 30, 1938, the average dropped to 1,276. Allotments for administrative expenditures amounting to $28,400 were also provided.

At the beginning of the year personnel was furnished from 20 C. C. C. camps for gypsy moth work in territory between the barrier zone and the Connecticut River in New England. The number has been decreased to 11 camps. There was a reduction from the previous year, averaging about 50 percent, in the emergency funds available for work on this project. This caused the work, except in New Jersey and Pennsylvania, to be confined to the barrier zone in New York and New England and to points where the most severe infestation occurred directly east of the zone.

The impossibility of using men on emergency funds or those in C. C. C. camps in places at all remote from their homes or the camps made it impossible during the year to cover some of the territory where the work should logically be done.

Spraying equipment which was reaching the stage of obsolescence was rebuilt, and improvements made in other equipment. Work was continued on the development of distributing apparatus to use in an autogiro for effectively treating forest areas by spraying from the air.

Cooperation was maintained with the Northeastern Forest Experiment Station in connection with systematic thinning of selected areas to reduce the percentage of food plants favored by the gypsy moth without seriously injuring the value of the woodland stand or eliminating the more useful species. Plots covering over 240 acres were treated and are under observation.

An attempt was made to determine the value and accuracy of estimating the degree of defoliation by observing and recording existing conditions from an autogiro. There are distinct advantages in doing the work in this way instead of by ground survey, and if this plan can be further developed it is believed that the record of defoliation can be more accurately and economically made.

Defoliation by the gypsy moth in territory east of the Connecticut River in the summer of 1937 covered 608,000 acres, a larger acreage than previously recorded. This was particularly serious in Maine and Massachusetts, where many thousands of acres of solid woodland growth, in addition to shade and ornamental trees on roadsides and home grounds, were completely defoliated in midsummer. Considerable acreage was affected in New Hampshire. A relatively small acreage of feeding by this insect occurred in territory between the Connecticut River and the barrier zone, and no evidence of feeding was reported in the zone or in New York, New Jersey, or Pennsylvania.

The deposit of egg clusters in the summer of 1937 was heavy in many areas, but only a small number were noted in sections where complete defoliation occurred. Most of the egg clusters were normal or above normal in size, indicating heavy defoliation in 1938. The winter of 1937–38 was unusually mild, with a moderate snowfall, and there was every prospect that a high percentage of the eggs would hatch in the spring. Early in April the weather was unseasonably warm and hatching occurred earlier than usual. This was followed by cold, wet weather accompanied in many sections by heavy frosts. In consequence, mortality of small larvae during this period was very high and hence the acreage defoliated in the summer of 1938 may be considerably reduced. In spite of unfavorable weather for spraying during the last part of May and in June, 70 sprayers were operated and the larger portion of the program was carried through.

In July 1937 assembling cages to the number of 2,142 were placed in the field in southern New York, 97 cages were placed in 5 towns in New Jersey where it was believed infestation was most likely to occur, and 984 cages were placed

in 13 towns in Pennsylvania beyond the outside rim of the area known to be infested. Five male moths were caught at three cages in the eastern part of Putnam County, N. Y., not far from known infested territory. No moths were secured in Pennsylvania or New Jersey. Sufficient material was collected in the summer of 1938 for use in 7,100 cages.

SCOUTING AND TREATMENT FOR THE GYPSY MOTH

Work in Maine was confined to intensive scouting of sites of infestations discovered in 1937 in Baileyville, Calais, Cooper, Indian Town, Machiasport, Princeton, Topsfield, and Trescott, all in Washington County not far from the Province of New Brunswick, Canada. Of the 4 infestations found, 2, each consisting of a single egg cluster, were discovered in the residential section of Calais, and 2, totaling 28 egg clusters, were located in the town of Princeton. All egg clusters were destroyed by creosoting, and it is hoped that these infestations have been exterminated.

The Division of Plant Protection of the Department of Agriculture of Canada carried on scouting in the Province of New Brunswick across the international border from the infestations in Maine. A number of small infestations were found in St. Stephen and adjoining territory, and thorough clean-up measures were applied.

In Vermont most of the W. P. A. funds allotted to the State were used in scouting within the barrier zone and immediately to the east where the threat to the zone appeared greatest. Most of the infestation in the State is in the Connecticut River Valley, the insect being found in many localities from the Massachusetts line north to Barnet. Scouting was done in Rutland and surrounding towns east of the zone, and in Ludlow, Mount Holly, and Shrewsbury clean-up work was applied in several small colonies found during the winter. No infestation was found in the barrier zone. The sites of infestation discovered near the Canadian border at Essex and Derby during 1936 were again intensively checked, with negative results. No spraying was undertaken in Vermont this season.

In Massachusetts scouting, the removal of favored food plants by selective thinning, burlapping, and spraying were performed in the barrier zone and a few towns to the east where wind spread into the zone seems most likely to occur. In the area between the zone and the Connecticut River infestation is present and in many places exceedingly heavy. In the zone area more infestations were discovered than during the preceding year. Most of them were in the southern portion. From their small size and scattered distribution it seems probable that these infestations were established as a result of wind spread from the east and south some 2 or 3 years ago. Eight sprayers were used in the Massachusetts barrier-zone area and five in treating infestations threatening the zone to the east.

In Connecticut W. P. A. and regular funds available were used chiefly in the barrier-zone area and most of this work was confined to Litchfield County where, because of insufficient labor in 1936 and 1937, infestation has increased. Eighteen sprayers were used in treating infestations found in this county. In the southern part of the zone in Connecticut infested areas were not found.

About 85 percent of the W. P. A. scouting and clean-up work was done throughout the entire barrier-zone area and 15 percent east of the zone.

In New York intensive scouting was done in selected areas by Federal W. P. A. forces, C. C. C. camp enrollees, and regular State employees supervised by the New York Conservation Department. The infestation discovered in Putnam Valley in 1937 was greatly reduced and only 12 small, isolated infestations were discovered in 9 other townships in the barrier zone. Early in the year a sizeable infestation was discovered in the township of Hague and 14,865 egg clusters were located and destroyed. The infestation found in the town of Shawangunk, Ulster County, in 1937, was so reduced that extermination in the near future seems likely. No infestation was found in the Borough of the Bronx and only 11 infestations, totaling 173 egg clusters, were located and destroyed in Nassau County on Long Island. Twelve Federal and five State sprayers were used in spraying the infestations discovered in New York. Fourteen hundred shipments originating in the area in Nassau County, regulated on account of the gypsy moth, were inspected and certified as free from this insect.

A small force of W. P. A. workers supervised by New Jersey gypsy moth employees performed intensive scouting in selected areas in Morris and Union Counties. The State force also made a special survey in 37 townships or municipalities in northeastern New Jersey. No evidence of the gypsy moth was found in the State.

In Pennsylvania scouting and treatment were continued in Lackawanna, Luzerne, Carbon, Monroe, Pike, and Wayne Counties. As usual first attention was given to an examination of the lowlands bordering the Susquehanna and Lackawanna Rivers within the area where infestation was first found in this region. Both sides of these rivers, as well as the islands, were covered for 31 miles. No infestation was discovered along the Susquehanna River but two infestations were found on the Lackawanna River not far from its confluence with the Susquehanna near Pittston. Although infestation was discovered for the first time in the township of Damascus, Wayne County, and in Paradise Township, Monroe County, conditions in the outside territory as a whole have improved. No infestation was found at sites of 38 outlying infestations discovered during the fiscal year 1937, and it seems certain that further treatment will not be required in many of these areas. Twenty-seven sprayers were used in the Pennsylvania area during the season just closed in treating the most serious of the infestations found.

The fourth revision of the State of Pennsylvania Quarantine on Account of the Gypsy Moth was put into effect February 15, 1938, and provides some modification of the quarantine. During the year 63,281 shipments were inspected and certified as free from the gypsy moth and 15,464 shipments were allowed to move under permit. A total of 136 egg clusters were located and destroyed on shipments offered for inspection.

The condition of the area in Pennsylvania that has been infested for the longest time has improved. A few large colonies were found but no defoliation has been reported since the work in Pennsylvania began after the original infestation was discovered.

GYPSY MOTH WORK BY CIVILIAN CONSERVATION CORP CAMPS

For the last 5 years men have been detailed from C. C. C. camps for work on the gypsy moth project in New Hampshire, Vermont, Massachusetts, and Connecticut, the principal purpose being to examine territory between the barrier zone and the Connecticut River and apply treatment to infested areas to protect the barrier zone from reinfestation. During this period most of the territory mentioned has been examined by these men or by W. P. A. employees supervised by the Bureau. Many areas, however, have not been scouted owing to their distance from the camps or from points where W. P. A. men were available. The camp force available for gypsy moth work reached its peak in 1936 and since then has decreased, the number available in the fiscal year 1938 being 50 percent less than in the previous year. At present 80 men are available from 2 camps in Vermont, 290 men from 4 camps in Massachusetts, and 130 men from 5 camps in Connecticut; in all, 500 men.

Intensive treatment, including selective thinning of woodland, was carried on chiefly in the areas where the heaviest infestations existed that were within the allowed distance from the camp concerned. On account of the reduction in C. C. C. force, including a drastic cut in supervision, it was necessary to concentrate the work where it could be reached by the camps regardless of pressing work in more remote areas.

Some work was carried on in 70 towns, as follows: 17 in Vermont, 23 in Massachusetts, 26 in Connecticut, and 4 in New Hampshire. Infestations were found in 58 towns. Work was done in 525 infestations, 47 of which appear to have been exterminated, since careful follow-up work has failed to show any signs of the pest. Most of those exterminated were in Connecticut, where the colonies were small and isolated and where it was possible to carry on the work without interruption.

Because no spraying equipment was available in the C. C. C. organization, a large quantity of burlap was used as a partial substitute. Burlapping is very useful, not only in heavy infestations but in sparsely infested areas. In spite of the large volume of work done in the territory between the Connecticut River and the barrier zone, the insect increased in many localities. Small infestations were eradicated and even very severe ones were greatly reduced in intensity, and this gave added protection to the barrier zone and lessened the danger of westward spread. In local areas where intensive work was done the infestation was reduced. Thinning work improved forest conditions and left many areas less susceptible to infestation and damage. Cooperation was maintained throughout the year with the United States Forest Service and various State officials charged with the maintenance and general operation of the camps.

Table 4 gives a consolidated report of scouting and treatment work done by the Bureau during the year.

TABLE 4.—*Gypsy moth control work, fiscal year 1938*

State	Project	Scouting							Thinning		Fencing		Banding			Spraying		
		Open country scouted					Woodland scouted	Egg clusters creosoted	Woodland thinned	Trees cut in open	Wire erected	Wire removed	Burlap bands applied	Pupae crushed	Larvae crushed	Woodland sprayed	Residential properties sprayed	Trees in open sprayed
		Open areas	Road	Apple trees	Oak trees	Shade trees												
		Acres	*Miles*	*Number*	*Number*	*Number*	*Acres*	*Number*	*Acres*	*Number*	*Feet*	*Feet*	*Number*	*Number*	*Number*	*Acres*	*Number*	*Number*
Maine	Regular	6,750	40	6,150	101	8,245	2,622	30	0	0	0	0	0	0	0	0	0	0
New Hampshire	C. C. C.	10,025	43	2,765	0	2,225	21,830	0	0	0	0	0	0	0	0	0	0	0
Vermont	W. P. A.	258,389	1,260	243,535	31,748	678,333	310,896	26,860	138	1,215	0	121,064	5,204	33,331	64,633	0	0	0
	C. C. C.	21,251	163	28,625	11,399	64,263	50,699	425,509	352	448	0	0	104,486	205,082	1,214,169	0	0	0
Massachusetts	W. P. A. and regular.	43,554	452	67,403	9,265	115,283	99,186	71,039	646	85	389,606	363,637	77,711	992,007	572,568	2,316	26	336
	C. C. C.	9,726	133	27,646	11,243	22,349	42,622	3,368,992	1,401	8,674	0	0	349,363	1,654,778	6,487,167	0	0	0
Connecticut	W. P. A. and regular.	88,746	1,034	158,688	59,807	191,179	143,953	14,617	1,077	0	61,800	3,600	146,720	5,590	9,931	3,402	0	200
	C. C. C.	24,358	267	74,616	11,312	75,832	65,598	28,223	80	403	0	0	163,175	5,256	69,206	0	0	0
New York	W. P. A.	22,565	218	49,770	27,578	171,005	29,646	14,554	703	0	7,931	0	35,482	0	25,582	483	0	60
	State and C. C. C.	289,396	2,190	612,134	0	5,853,800	219,108	1,070	1,546	0	0	0	226,624	0	0	3,354	0	5,454
New Jersey	W. P. A.	468	12	5,268	194	5,622	2,269	0	0	0	0	0	2,880	0	0	0	0	0
Pennsylvania	W. P. A.	84,178	846	161,724	91,633	615,178	173,896	215,151	1,727	81	201,716	173,188	598,981	55,055	162,810	5,166	2,091	75,596
Total	W. P. A. and regular.	[1] 794,046	[1] 6,052	[1] 1,304,672	220,326	[1] 7,638,645	[1] 931,486	[1] 343,321	[1] 5,837	1,381	652,053	661,489	[1] 1,003,602	1,085,893	835,574	[1] 14,721	2,117	[1] 81,646
	C. C. C.	[2] 65,360	[2] 606	[2] 133,652	33,954	[2] 164,669	[2] 180,659	[2] 3,822,724	[2] 1,833	9,525	0	0	[2] 617,024	1,865,116	7,770,542	0	0	0
Grand total		859,406	6,658	1,438,324	254,280	7,803,314	1,162,145	4,166,045	7,670	10,906	652,053	661,489	1,620,626	2,951,009	8,606,116	14,721	2,117	81,646

[1] Including State and C. C. C. in New York.
[2] Not including C. C. C. in New York.

GYPSY MOTH AND BROWN-TAIL MOTH QUARANTINE ENFORCEMENT

CERTIFICATION OF QUARANTINED PRODUCTS

An increase was noted in the number of gypsy moth egg clusters removed from products offered for inspection and certification. Many wood lots from which quarantined products previously had been moved on the basis of freedom from infestation of the area involved disclosed infestation, thereby greatly increasing the amount of piece-by-piece inspection of forest and evergreen products.

In the course of the year inspectors removed 1,382 egg clusters, 102 larvae, and 25 pupae from material examined prior to removal to noninfested territory. Finds of from 25 to 50 egg clusters on a single carload shipment of lumber were not uncommon. The most heavily infested shipment examined during the year was a carload of lumber inspected at Brownfield, Maine, for movement to Syracuse, N. Y. The inspector removed 116 egg clusters from the boards in this shipment.

Reduction in certification activities in a number of sections in the northwestern part of the regulated zone permitted a realignment and a reduction in the number of districts assigned to individual inspectors. The area is now divided into 18 instead of 21 districts. Inspectors thus released were transferred to districts requiring extra men.

Rules and regulations governing the movement of quarantined products continued as last revised on November 4, 1935. A revised administrative order issued September 13, 1937, added a few items to the articles already exempt from the quarantine restrictions.

Shipments of evergreen boughs started about November 10, and movements of Christmas trees began on November 15. In western Massachusetts and southern Vermont inspection of evergreen-bough lots was practically completed by the end of November. Christmas-tree inspections continued through December 15. Tabulation of certification records for the Christmas-tree shipping season of 1937 shows a 20 percent increase in the number of trees inspected. Compared with 634,365 trees inspected in the fiscal year 1937, this year's total was 763,062.

There was a considerable increase in the certification of material intended for manufacture into Christmas wreaths and decorative pieces. Many tons of fir balsam boughs, later cut into small pieces for use in Christmas wreaths, required individual inspection. In some instances balsam boughs were found so heavily infested that they could not satisfactorily be rid of egg clusters, and certification was denied.

Temperatures above normal in March and April resulted in the hatching of egg clusters late in April in all New England States except Maine and Vermont. In the latter States hatching started about May 5. Observations by district inspectors in June indicated that defoliation in the woodlands in many districts of the infested area was lighter this year than in the past several years. Unusually early hatching of the eggs in the spring, followed closely by late frosts, caused a heavy mortality among the young larvae.

Sixteen egg clusters, 17 larvae, and a pupa were removed from 24,856 lots of nursery stock certified during the year. Nursery products shipped under certification were as follows:

	Number
Shrubs	2,516,169
Specimen trees	46,194
Young trees	254,095
Specimen evergreens	255,311
Young evergreens	2,142,866
Seedlings, cuttings, and small plants	4,066,330
White pine trees	321,599

Most of this material was jointly certified in compliance with both the Japanese beetle and the gypsy moth quarantine regulations.

Table 5 gives summaries of the quantities of quarantined products other than nursery stock certified during the year.

TABLE 5.—*Evergreen products, forest products, and stone and quarry products certified under gypsy moth quarantine, fiscal year 1938*

Material	Quantity	Certificates issued	Gypsy moths found		
			Egg clusters	Larvae	Pupae
Evergreen products:		*Number*	*Number*	*Number*	*Number*
Boughs, balsam twigs, and mixed greens boxes or bales	51,837		58		
Christmas trees number	763,062				
Laurel boxes or bales	12,508				
Miscellaneous boxes	4,979				
Do feet, roping	6,218		5		
Do truck loads	2				
Total		18,837	63		
Forest products:					
Barrel parts, crates, crating cases, bundles	6,238				
Logs, piles, posts, poles, ship knees, and ties pieces	2,048,722		78	21	7
Fuel wood do	3,350		78		
Miscellaneous wood do	1,549		6		
Pulpwood cords	54,632		227		
Lumber board feet	40,394,301		880	[1] 63	9
Empty cable reels number	22,524			1	5
Shavings bales	40,509				
Shrub and vine cuttings boxes	3,938		2		
Lags bundles	9,256				
Miscellaneous pieces	449,665		2		
Do carloads	41		13		
Do trucks	2		9		
Total		20,213	1,295	[1] 85	21
Stone and quarry products:					
Crushed rock tons	482				
Curbing running feet	37,155				
Feldspar tons	15,215				
Granite pieces	152,044				
Do tons	11,263		8	0	3
Monumental stone do	22,035				
Grout do	38,763				
Marble pieces	299				
Paving blocks number	1,098,504				
Miscellaneous pieces	30,084				
Do tons	138				
Do carloads	6				
Total		22,787	8	0	3

[1] 1 female moth.

VIOLATIONS

Apparent violations of the gypsy moth and brown-tail moth quarantine investigated numbered 1,140.

From November 20 to December 23, while shipments of Christmas trees were moving from the gypsy moth regulated area to New York City via freight and truck, four inspectors were temporarily stationed in the city to check on the certification of trees upon their arrival. Several truckloads of uncertified trees were intercepted and their return to the infested area accomplished. Three Connecticut truckers failed to return their loads to the point of origin and were prosecuted. One conviction carrying a $25 fine was obtained. Two cases were pending at the end of the year.

DUTCH ELM DISEASE ERADICATION

GENERAL STATUS

Pronounced decreases in the number of confirmations of trees infected with the Dutch elm disease during the 1937 foliar season, coincident with earlier and more intensive scouting, afford a basis for hope for eventual eradication of this disease. Most of the main infected area is still confined to territory within a radius of 50 miles from New York City. Outside this zone of continuous infection first-record infections were limited to Athens, Ohio, and Wileys Ford,

W. Va. In Indianapolis, Ind., infections increased from 39 to 85. Negative results of the season's scouting in Cleveland, Ohio, were particularly gratifying, since they confirmed for the second consecutive year the effectiveness of the sanitation program in that city during the winter of 1935–36. Discoveries of diseased trees in Dutchess County, N. Y., extended the northernmost point of infection to approximately 70 miles from New York City and 20 miles from the southwestern Massachusetts border.

SYSTEMATIC SCOUTING

Systematic scouting during 1937 had been in progress for a month prior to the present fiscal year. From June 1, when scouts were placed in the field, until September 30, when yellowing of the leaves forced a discontinuance of the field observations, scouts located 5,497 trees which were later confirmed as infected with the fungus causing the disease. Of this total, 111 were in Connecticut, 4,215 in New Jersey, 1,136 in New York, and 35 in outside States. The only increases were of small numbers of trees in the Connecticut infected zone and at Indianapolis, Ind. New York netted a 33-percent decrease and New Jersey a 23-percent decrease, as compared with the 1936 foliar season. Total confirmations during the year reached an even 6,500. The grand total of elms in the country confirmed as infected since discovery of the disease in Ohio in 1930 is 29,625.

At the peak of the 1937 scouting season in the several States the scout force totaled 3,111, with 310 in Connecticut, 1,751 in New Jersey, 873 in New York, and 177 in outside areas. The maximum number of W. P. A. scouts in the field was 2,643.

Tentative quotas of scouts set for each State were not filled, owing to the difficulties in securing W. P. A. workers adapted to tree climbing, identification of elm and disease symptoms, and other qualifications necessary for satisfactory performance as scouts. All qualified men in sanitation crews were given an opportunity to attend scout schools, and those found satisfactory for this type of activity were transferred to scout crews.

Return to private employment of men on relief, dismissals for incompetence, and cancellation of W. P. A. workers' relief status made heavy inroads on the scout crews and necessitated the use of a lower grade of relief labor than in any previous scouting season. To offset this heavier load of inexperienced men, a larger number of trained tree workers were employed as crew foremen. The scouts were also required to give more detailed attention to elms showing any abnormal symptoms. This was particularly true in New York, where scouts on the first and second surveys sampled all elms with minor symptoms and took specimens from all English elms. Confirmation, as infected, of an English elm which showed no external symptoms except stagheadedness and only faint discoloration after repeated sampling was the occasion for the issuance to New York scouts of instructions to submit samples from each major limb of all English elms observed. Although this resulted in slower coverage of the areas, the intensified sampling lessened the risk of overlooking infected trees.

Closer attention to minor symptoms resulted in a large increase in the seasonal total of twig samples collected for dispatch to the laboratory. The record collection of the year amounted to 9,417 samples for the week ended August 21. The total of samples collected during the summer was 75,156, or a 34-percent increase for the year.

In extent the three surveys of the work area during the summer of 1937 slightly exceeded those of the previous summer. The entire work area in Connecticut was covered twice, and there was a third coverage of the infected zone plus one-fifth of the protective area. In New Jersey the work area was completely scouted on the first go-over and was entirely covered a second time except for 100 square miles scattered in the work areas of Hunterdon, Somerset, and Warren Counties. A third coverage in New Jersey was carried on in 1,681 square miles scattered throughout the work area. Two hundred square miles in the vicinity of localized disease concentrations in six New Jersey counties received a fourth go-over.

On the first survey in New York, scout screws covered the entire infected area and 25 percent of the protective zone. The second go-over in the State extended to 90 percent of the infected area. The third New York survey included approximately one-third of the known infected area.

Approximately one-third of that portion of the protective zone which extends into Pennsylvania was scouted by foot scouts, and the remainder was covered by an autogiro crew.

It is possible for the second consecutive year to cite substantial decrease in the number of confirmations. Confirmations on Staten Island have decreased from 653 in the summer of 1934 to 326 in 1935, 70 in 1936, and 32 in 1937. Similar conditions were found in the Bronx, New York City, where successive years' confirmations of 452, 334, and 185 were this year reduced to 82. In Caldwell Township, Essex County, N. J., one of the most heavily infected areas in the State, confirmations declined from 398 in 1935 and 41 in 1936 to 14 this year.

Scouting of isolated infections in 1937 was directed from field stations established in Baltimore, Md., and Indianapolis, Ind. Summer activities outside the major infected area resulted in the finding of 5 confirmations near Wileys Ford, W. Va., a single diseased tree in Athens, Ohio, and 25 additional confirmations in the Indianapolis, Ind., isolated infection. Scouts covering territory surrounding the location where a single diseased tree was found near Cumberland, Md., in 1936 discovered five infected trees near Wileys Ford. One of these was rather close to the Cumberland tree. Three additional trees confirmed as infected were closely clustered at a distance of 3 miles from the Cumberland infection, while a fifth tree was found 6 miles farther west. The diseased tree in Athens, Ohio, was found by a crew engaged in foot scouting of railroads running through an area infested with the smaller European elm bark beetle, determined last year in a partial survey of the Ohio River and some of its tributaries. This tree was located on the bank of the Little Hocking River, near the Baltimore & Ohio Railroad. About half the crown had died in 1936, and discoloration was found in the last three annual rings.

Cooperative scouting work in Indianapolis in 1937 was more efficiently supervised and more adequately manned than in any previous year. Activities in Indianapolis for most of this year were intensified under the direction of a pathologist transferred to that point from the field headquarters early in June. A handicap in previous years' operations, occasioned by the necessity for employing untrained W. P. A. scouts, was in a large measure overcome by the assignment of seven experienced tree men on Federal pay roll, each to serve as foreman of a scout crew operating in the city. Five of these crews were each supplemented by an experienced tree worker hired by the State of Indiana. In addition to the systematic scouting in Indianapolis and vicinity, an autogiro crew and ground scouts spent from September 1 to 27 in observations of suburban areas surrounding and at some distance from the city.

Following the purchase of two additional autogiros on May 17 and July 14, 1937, the autogiro scouting units were built up to four serviceable giros, with accompanying pilots, observers, and ground crews. One aerial unit scouted 11,000 miles of railroad right-of-way over which imported burl elm logs traveled from ports of entry to Midwestern veneer mills. This was accomplished by scheduled flying over southern and northern loops of connecting railroads. The railroad scouting for 1937 started on May 21 and was concluded on August 24. The three remaining aerial crews and their follow-up ground crews performed special scouting, largely confined to mountainous sections of the protective zone that are difficult to scout afoot. One crew spent most of the season in aerial observations in Orange, Rockland, Dutchess, and Putman Counties, and a portion of Westchester County, N. Y., along with a small section in the Connecticut protective zone. Two crews operated in the western strip of protective area bordering the Delaware River in New Jersey and Pennsylvania.

Additional infestations of *Scolytus multistriatus*, the principal insect vector of the disease, were found at a number of localities heretofore unreported. A scout crew located an infestation on the Indiana side of the Ohio River opposite the junction of the Green River, near Evansville, Ind. Another crew, working at Mount Vernon, Ind., found an elm infested with this species floating in the Ohio River.

Scout schools for the summer season of 1938 opened June 6 in Connecticut and New York. Approximately 275 men were trained in Connecticut. In New York 610 men reported for training. Schools started on June 7 in New Jersey, and at Easton, Pa., 15 men completed the quota on June 9. Training was also carried on in all the isolated infected areas. Systematic scouting began on June 13, and by June 18 practically all scouts were in the field.

Following resumption of scouting at isolated points of infection, 17 diseased trees were located in Indianapolis and 1 additional case was disclosed at Athens, Ohio. Previously four trees, confirmed as infected, had been observed at Indianapolis during progress of the elm-sanitation work.

First observation of early-season wilting typical of the Dutch elm disease was made in New Jersey on May 20, 1938, in Somerset County.

The one-millionth culture plate for testing elm chips for the Dutch elm disease was poured at the Morristown, N. J., laboratory on May 13; the first was poured there on June 5, 1934. During 1937 a total of 338,152 plates were poured.

For the year the number of samples collected from trees showing apparent symptoms of the disease was 101,869. Upon examination of the cultures 6,500 of these were confirmed as infected with the Dutch elm disease. Listed by States, confirmations were as follows: 154 in Connecticut, 4,988 in New Jersey, 1,305 in New York, and 53 at the three isolated infection points in West Virginia, Ohio, and Indiana. Compared with the previous year's 7,640 confirmations, which marked an increase of 17 percent over 1936, this year's total was a decrease of 15 percent.

Total infected trees recorded to date in outlying areas are as follows: Indianapolis, Ind., 85; Baltimore 2, Brunswick 3, and Cumberland 1, in Maryland; Cleveland 33, Athens 2, and Cincinnati 1, in Ohio; Wileys Ford, W. Va., 5; and Norfolk, Va., 5; or 137 in all.

EXTENSIONS OF WORK AREA

Extensions of the infected zone necessitated by the discovery of diseased elms in the 10-mile protective zone surrounding the known infected area were limited to 14 townships and cities. These were as follows: In New Jersey, West Amwell, Delaware, and Holland in Hunterdon County, Atlantic and Asbury Park in Monmouth County, and Hope Township in Warren County; in New York, Cornwall, Hamptonburg, and New Windsor in Orange County, and Fishkill, Poughkeepsie, and Hyde Park in Dutchess County; and in Connecticut, the towns of Redding and Weston in Fairfield County.

Aside from the Dutchess County extension, the infected zone now totals 5,450 square miles, divided as follows: 308 square miles in Connecticut, 3,031 in New Jersey, and 2,111 in New York. These represent increases for the year of 32 square miles in Connecticut, 88 in New Jersey, and 197 in New York. The 10-mile protective zone circumscribing the infected area comprises 707 square miles in Connecticut, 807 in New Jersey, 507 in New York, and 1,283 in Pennsylvania, a total of 3,304 square miles. This is an increase of 254 square miles over the previous year. The entire zone of field operations totals 8,754 square miles.

Revised Dutch elm disease quarantine regulations, effective November 9, 1937, added to the regulated area all towns infected on that date. One conviction for a quarantine violation resulted in a nominal fine.

ERADICATION AND SANITATION ACTIVITIES

Elms in infected areas difficult to scout and dead and dying trees in the areas of disease concentration were removed at a rapidly accelerated rate. In areas permissioned for clear-cutting, approximately 495,000 elms were removed. Also, approximately 528,000 dead and dying trees in the major infected field were removed. An additional 177,000 elms were removed in selective cutting in areas surrounding disease concentrations. There remained standing at the end of the year approximately 131,000 trees tagged for removal, as compared with 338,000 tagged for removal at the beginning of the year. The total number of trees removed in clear-cutting and sanitation work, plus over 6,000 diseased trees eradicated, was approximately 1,206,000. To June 30, 1938, a grand total of 4,530,244 trees have been removed in all activities. By far the largest number of these, 2,775,741, were removed in New Jersey. Such trees as have been removed, although of negligible economic or esthetic value, were recognized as likely centers of chronic cases of the Dutch elm disease and as breeding places for the insect carriers of the disease.

Special elm-sanitation projects were completed at three isolated sections, and at several points of disease concentration in New Jersey. At Athens, Ohio, crews engaged in clear cutting along the Little Hocking River near the location of the initial infection and in the built-up section of the city. In April removal of all worthless trees was begun. Beetle-infested wood was pruned from the remaining valuable elms within 1 mile of the diseased tree. Approximately 30,000 brush elms were removed by May 21.

All elms in the vicinity of the trees at Wileys Ford, W. Va., confirmed as infected were pruned and sampled. In Indianapolis, Ind., 92 men assigned to

winter-sanitation work completed their duties by June 1. Clear cutting was performed in several regions in New Jersey where elms were found in the summer of 1937. In two heavily infected sections in Allamuchy Township, Warren County, N. J., 13 trees confirmed as infected were located around several wood piles containing elm logs.

SOURCES OF FUNDS

Federal activities of the project during the year were financed from a regular Departmental appropriation of $460,860, supplemented by several allotments of Works Progress Administration funds totaling $2,870,686 for field operations and $34,000 for administrative expenses.

State appropriations and contributions toward the cooperative work amounted to $140,000 in New York, $41,580 in New Jersey, and $25,000 as a biennial appropriation in Connecticut. In addition $404,883 of W. P. A. funds was made available in Connecticut for a program of elm pruning and dead-tree removal, sponsored and supervised by State officials. The State of Indiana contributed the services of five experienced tree men for 3 months. The Department of Parks of the City of New York took care of the removal of all dead and dying elms on city property. Approximately $30,000 was expended by 55 municipalities in Connecticut carrying out elm-sanitation projects.

WHITE-PINE BLISTER RUST CONTROL

EXTENSIVE WHITE PINE AREAS PROTECTED IN 1937

During the field season of 1937, 75,062,268 currant and gooseberry plants (*Ribes*) were destroyed on 2,469,356 acres of control area in the protection of over 1,000,000 acres of commercially valuable white pine forest. On the area covered, 1,626,045 acres consisted of initial work and 843,311 of areas covered one or more times previously since 1918. The project required 501,773 man-days of labor.

Since 1933 this work has been conducted largely by the use of relief labor. The amount of funds allotted to blister rust control from emergency relief appropriation acts was less than half the amount granted during the previous year, and as a result the employment of relief labor dropped from some 14,000 men in 1936 to a peak employment of about 4,500 in 1937. In addition, the number of enrollees assigned to the work from the C. C. C. camps was less than in the previous year.

The details of this control work are given in table 6.

TABLE 6.—*Ribes-eradication operations for the calendar year 1937*

Region	Area covered			Effective labor [1]	Ribes destroyed
	Initial work	Rework of areas covered one or more times previously	Total initial and rework		
	Acres	*Acres*	*Acres*	*Man-days*	*Number*
Northeastern States	377,223	339,499	716,722	212,713	17,424,376
Southern Appalachian States	844,034	404,739	1,248,773	48,812	5,216,119
Lakes States	281,407	29,112	310,519	66,654	[2] 15,808,034
Western white pine area (Idaho, Montana, Washington including Mount Rainier)	85,918	35,122	121,040	116,881	26,683,975
Sugar pine area (California and Oregon)	27,051	34,839	61,890	52,670	9,526,570
Rocky Mountain States (Colorado and Wyoming)	10,412		10,412	4,043	403,194
Total	1,626,045	843,311	2,469,356	501,773	75,062,268

[1] Reported as effective 8-hour man-days; the time actually worked ranged from 6 to 8 hours per day.

[2] The annual report of the Chief of the Bureau of Entomology and Plant Quarantine for 1937 (table 11, p. 34) shows 7,741,501 as the number of *Ribes* destroyed in the Lakes States in 1936. This should be corrected to read 57,741,501.

White pine areas are considered to be protected from blister rust when the *Ribes* are removed from the pine stand and for a distance of 900 feet on all sides of the stand. Occasional checking and reworking of portions of these areas are necessary at intervals of 5 to 10 or more years to maintain them free from large bushes throughout the crop rotation.

Of the acreage recorded above, about three-fourths, or 1,795,096 acres, was covered during 1937 by eradication crews paid under allotments to the Bureau of Entomology and Plant Quarantine and to the Forest Service from the Emergency Relief Appropriation Acts of 1936 and 1937. The C. C. C. enrollees covered 530,155 acres, devoting 178,870 8-hour man-days to the work. The remaining 144,105 acres were financed by numerous other cooperating agencies. Among the largest non-federal cooperators were the States of New York and Idaho, both of which provided substantial appropriations for the protection of the white pine within their borders.

STATUS OF CONTROL WORK ON DECEMBER 31, 1937

In the country as a whole there is estimated to be about 30,000,000 acres of control area, which contains between 14,000,000 and 15,000,000 acres of white pine of sufficient stocking to produce a good crop of timber at maturity. The control work is aimed at eliminating the *Ribes* on these areas so as to make them safe for the continued production of white pine. When the white pine areas are being selected, preference is given to the better sites and more valuable stands of young growth. The northern white pine of the Eastern States, the western white pine of the "Inland Empire", and the sugar pine of California and Oregon are the principal commercial species and have a high present and future commercial value. They constitute the principal white pine resources of the Nation, and the maintenance of all three as a component of our forests is highly desirable. Table 7 shows that initial protection by *Ribes* eradication has been given to 20,200,712 acres of control area. Of this area, 4,041,132 acres have been reworked. This protection work has been accomplished during the last 20 years through the destruction of 831,857,039 *Ribes*.

TABLE 7.—*Blister rust control accomplishments, 1918–37*

Region	Work accomplished 1918–37			
	Initially protected control area	Rework areas subsequent to initial protection	*Ribes* destroyed	Effective labor [1]
	Acres	*Acres*	*Number*	*Man-days*
Northeastern States	11,598,428	3,018,485	234,680,094	2,118,526
Southern Appalachian States	4,191,779	695,478	17,840,131	154,619
Lakes States	2,079,333	133,823	168,106,398	638,701
Western white pine area	1,712,403	114,281	328,785,651	1,367,382
Sugar pine area	582,331	79,065	80,970,149	296,419
Rocky Mountain States	36,438		1,474,616	13,099
Total	20,200,712	4,041,132	831,857,039	4,588,746

[1] Reported as effective 8-hour man-days; the time actually worked ranged from 6 to 8 hours per day.

CONTROL WORK CARRIED ON IN COOPERATION WITH AFFECTED STATES AND FEDERAL AGENCIES

In the white pine regions of the country blister rust-control work is performed under State laws which provide the necessary legal authority for carrying out the control activities within the respective States. The work is conducted cooperatively with the affected States and with other Federal agencies responsible for the administration of public lands. The Department, through this Bureau, provides the leadership, technical supervision, and coordination needed to secure effective eradication of *Ribes* in white pine areas. The cooperating States enforce their respective State laws, determine State policies affecting the work, cooperate with counties, townships, municipalities, and individuals in the eradication of *Ribes*, and provide some of the funds and labor for control work.

The Bureau cooperates in a similar manner with other Federal agencies such as the Forest Service, National Park Service, Indian Service, and Soil Conservation Service. These agencies provide funds and labor for such *Ribes* eradication as is necessary on the public lands under their administration. The work plans are cooperatively prepared and carried out, thus assuring mutual interest and coordination of control activities.

CULTIVATED BLACK CURRANTS DESTROYED IN THE WHITE PINE REGIONS

The cultivated black currant (*Ribes nigrum*) is the most susceptible species of *Ribes* and is responsible for aiding the long-distance spread and local establishment of the disease to a far greater extent than any other species of *Ribes*. For this reason it is being eliminated throughout white pine regions, where it has small commercial value as compared with the value of the white pine. This work is therefore not confined to the control zones immediately adjoining white pine stands.

Cultivated black currants were largely eliminated some years ago in the western white pine and sugar pine regions in order to delay the spread of the disease. In the Northeastern States they have been eradicated wherever found, along with other cultivated *Ribes* in the white pine region, and in some of these States have been outlawed and completely eliminated so far as possible. In the Lakes States region they have been eradicated from large sections of the white pine areas in the last 2 years. In 1937, 26,904 plants of *Ribes nigrum* were destroyed, most of these in the Lakes States region.

WHITE PINE NURSERY STOCK PROTECTED AGAINST BLISTER RUST INFECTION

White pines are extensively used for reforestation purposes, particularly in the Eastern States and in the western white pine region. Many of the State forestry departments, as well as the Forest Service and the Soil Conservation Service of the Department, are using white pines extensively for planting purposes. To assure the planting of white pine free from blister rust, the nurseries producing this stock are protected against blister rust infection by the eradication of *Ribes*. The protection of such nurseries was carried out in 1937 in and around 121 nurseries, of which 34 were located in the Northeastern States, 36 in the southern Appalachian region, 49 in the Lakes States, and 2 in the western white pine region. These nurseries were growing 116,845,668 white pines. In protecting them 374,577 *Ribes* were destroyed in 1937 on 48,376 acres. Most of these *Ribes* were found around nurseries being worked for the first or second time. In addition to the protection of white pine stock while it is growing in the nurseries, arrangements are made with agencies engaged in reforestation work whereby the sites to be reforested with white pine are examined prior to their being planted. So far as possible sites are selected that are free of *Ribes*, or that contain so few that these can be easily eradicated.

VALUABLE PLANTED AND ORNAMENTAL PINES TREATED

Trees of high value, such as ornamental pines, pines in public parks, or pines planted on watersheds representing a considerable investment, can often be saved after they have become infected, if the disease has not progressed too far to prevent the effective removal of the diseased portions. Such work is practical only on ornamental pines or planted pines of high value and is not recommended as a control measure in native forest areas.

During 1937, 170,163 cankers were removed in this manner from 108,789 white pines in the southern Appalachian, Northeastern, and Lakes States regions. In the course of this work 1,157,133 trees were examined and 106,615 were found so badly diseased that they could not be saved, and the trees were cut down and removed.

WHITE PINE AREAS MAPPED

During the fall and winter seasons, when *Ribes* eradication cannot be effectively carried on because of the dropping of the leaves, attention is given to the location and mapping of white pine as a basis for the future application of control measures. The best of the white pine areas are selected and located on maps, and information is obtained concerning the pines and abundance of *Ribes*, and on working conditions. During 1937, 4,472,811 acres of white pine area were mapped.

DEVELOPMENT OF CONTROL PRACTICES

Experimental work was continued to develop improved control practices for the chemical treatment of certain species of western *Ribes* that are difficult to eradicate by hand methods. In this work it was found that *Ribes roezli, R. viscosissimum,* and *R. nevadense,* which occur in heavy concentrations of mature bushes, can be eradicated by decapitating the bushes close to the ground and treating them with Diesel oil of 29° Baumé at the rate of 0.05 gallon of oil per average large plant. For the treatment of occasional troublesome bushes of these species, the application of 2 ounces of dry ammonium thiocyanate or sodium thiocyanate to the decapitated crowns is effective. It was found that seedlings of *R. roezli* in reeradication work could be destroyed by spraying with Diesel oil at the rate of 1 gallon of oil per 100 small plants. In such work 3-year-old plants having 15 feet or more of live stem should be decapitated and the crown oiled or grubbed. Experiments were continued with *R. bracteosum* and *R. cereum* to determine chemical doses for the treatment of decapitated large bushes of these species with Diesel oil and ammonium thiocyanate. *R. cereum* occurring in rock crevices can be treated by decapitation, and treatment of the crown with Diesel oil of 29° Baumé, or a mixture of Diesel oil and crankcase oil (4 to 1), at the rate of one-third of a gallon of the mixture for the average large clump. Studies were begun on the establishment and growth rate of *Ribes* subsequent to *Ribes* eradication, to obtain data from which to determine the right interval between initial and rework, and as a basis for working out better methods for eliminating these plants.

BLISTER RUST FOUND IN MANY NEW LOCALITIES IN 1937

In the West two major developments in the spread of the disease occurred during the season, one in California and the other in western Montana. Blister rust was first found in California in 1936 at five infection points in Del Norte and Siskiyou Counties, all within 5 miles of the Oregon border. In 1937 infections on *Ribes* were found to be generally distributed in Siskiyou County, and scattered infections were found in Shasta, Trinity, and Tehama Counties. The more southern infection points were 125 miles south of the Oregon border in the Coast Range Mountains along the headwaters of the Trinity River and 120 miles south in the Sierra Nevada just below Lassen Volcanic National Park. Past experience has shown that the results obtained in blister rust scouting are usually considerably behind its actual spread. It is therefore very probable that the rust may already be present south of the known limits of infection. The large areas of wild mountainous country to be examined and the 3-year incubation of the rust on pines make it impossible to be certain of the actual limits of spread.

In the Pacific Northwest a survey was undertaken to determine the extent to which blister rust is spreading southeastward toward the whitebark pine and limber pine forest areas of the Rocky Mountain region. Since 1927, when the rust was first found in the western white pine region of Idaho, rapid and serious intensification of the disease has been occurring on unprotected areas, and it is now evident that many stands of young white pine probably will be a total loss before the *Ribes* can be eradicated. While the disease has increased in the western white pine region, it has also spread to the surrounding country in which the susceptible whitebark pine and limber pine grow at the higher altitudes. Most of the acreage supporting these species is south and east of the western white pine stands, with extensive areas in southwestern Montana and in Wyoming and Colorado. The rust survey was conducted during September 1937, and infection on *Ribes* was found at 16 points in the Bitterroot, Beaverhead, Deer Lodge, and Gallatin National Forests. The discovery of the rust on the Beaverhead National Forest marked the first extension of the known range of the disease in the West to the east of the Continental Divide. The most eastern location was found on the Gallatin National Forest within 19 miles of the northwestern corner of Yellowstone National Park and 26 miles of the Wyoming line. The rapidity with which the rust is likely to spread in the whitebark pine and limber pine regions cannot be predicted. Both these species are highly susceptible to the rust and are associated with susceptible *Ribes.*

In the north-central region the rust was found for the first time on white pine in Antrim County, Mich., the Bad River Indian Reservation in Minnesota, and Monroe, Sauk, LaCrosse, Brown, Trempealeau, Florence, Kewaunee, and Marinette Counties, Wis. On *Ribes* the disease was found for the first time in Palo Alto County, Iowa; McHenry, Winnebago, Boone, Lake, and Kane Counties,

Ill.; Clinton, Washtenaw, Arenac, Gratiot, Wayne, Livingston, Agemaw, and Shiawassee Counties, Mich.; Fairfield and Lorain Counties, Ohio; and Trempealeau, Kenosha, Racine, Milwaukee, Walworth, and Waukesha Counties, Wis. Practically all the infection on *Ribes* in counties in Illinois and Wisconsin resulted from the spread of the rust on cultivated black currants.

In the northeastern region blister rust infection is general, the amount of the disease varying considerably in different localities. There are many local areas where infection on pine ranges from 10 to nearly 100 percent of the trees in unprotected areas. In well-protected areas pine infection has practically ceased, following the eradication of *Ribes*.

In the southern Appalachian region, extending from Maryland to Georgia, blister rust was found for the first time on *Ribes* in Delaware, where it was discovered in northern Newcastle County. It was also picked up for the first time on *Ribes* in Harford, Baltimore, and Carroll Counties, Md., and in Alleghany County, Va. The disease is now present in most of the counties in the white pine belt extending from Maryland southward along the Appalachian Mountains to central Virginia and West Virginia.

MODIFICATION OF WHITE-PINE BLISTER RUST QUARANTINE REGULATIONS

All restrictions on the interstate movement of five-leaved pines—except to points in two pine-growing regions in which the blister rust has not been found, one in the West and the other in the Southeast—were lifted in a modification of the white-pine blister rust quarantine regulations which became effective July 1, 1938.

An embargo is placed on the interstate movement of five-leaved pines into the western States of Arizona, Colorado, Nevada, New Mexico, Utah, Wyoming, and part of California, and into the Southeastern States of Georgia, Kentucky, North Carolina, South Carolina, and Tennessee, from States other than these 11 entire States and from 10 northern California counties.

The currant and gooseberry shipping regulations also are revised. The extensive Federal-State control work throughout the infected States is continued; and in order to protect accomplishments and to maintain sanitation zones around the valuable pine stands the control-area permit requirement is extended to apply to shipments to 23 States. The requirements as to dormancy, defoliation, or dipping of currant and gooseberry plants are continued in the case of shipments to the 12 pine-growing States to which pine shipments are prohibited. The embargo as to shipments of European black currants throughout the United States except into 12 Central States is continued unchanged.

CEREAL AND FORAGE INSECT INVESTIGATIONS

WHITE-FRINGED BEETLE

A new and serious insect enemy of field crops, the white-fringed beetle (*Naupactus leucoloma* Boh.), was discovered in August 1936 near Svea, Okaloosa County, in western Florida. It was subsequently found in Walton County, Fla., and in the neighboring county of Covington, in southern Alabama. Surveys immediately instituted resulted in the finding of this pest in New Orleans, La., and in the vicinity of Laurel, Miss.

This insect is native to South America, where it is known from Argentina, Chile, and Uruguay. Preliminary studies conducted in southern Alabama have shown that it has formidable characteristics. All the beetles are of the female sex and potentially able to reproduce at a very high rate. A single beetle may lay as many as a thousand eggs in the course of a few weeks. These are deposited on or in the soil or are attached to sticks, stones, or vegetation and, when subjected to dry conditions, live for many months, and hatch immediately when supplied with moisture. The newly hatched grubs are capable of living for weeks without food and can feed on the roots of almost every kind of herbaceous and many kinds of woody plants. The grubs attack practically all varieties of field crops, but are especially fond of cotton, peanut, cowpea, sweetpotato, corn, and velvetbean. They have, however, already been found feeding on 124 species of plants belonging to 41 families. The full-grown grubs have lived as long as 100 days when fully submerged in water. As they feed on the roots and underground stems of plants, embedding themselves in their tissues, they are very likely to be trans-

ported long distances through the shipment of nursery stock, either on the plants or in the soil surrounding the roots. As this insect is believed to have been present for some years, it is probable that spread by such means has already occurred. Fortunately the adult beetles are wingless and can spread unassisted only by crawling over the surface of the soil. Like the grubs, however, the beetles feed on a variety of plants, both cultivated and wild. Among their favorite cultivated host plants are cotton, peanut, velvetbean, and blackberry. As many as 80,000 beetles have been collected from one-half of an acre of cotton in 4 hours' time.

Active investigation of the biology and methods of control of the white-fringed beetle are under way. It has recently been found that a 25-percent emulsion of ethylene dichloride applied at the rate of 1 gallon per square yard killed all the grubs in the soil. Many kinds of insecticides are being tried against the adult beetle, as well as various mechanical methods of control.

GRASSHOPPERS

As stated in the last annual report, 20 States were furnished bait materials during the campaign for the control of grasshoppers. The formula used in estimating the number of tons of bait furnished was mill-run bran 500 pounds, sawdust 1,500 pounds, and sodium arsenite 10 gallons. The total amount of bait furnished the cooperating States was 75,439.37 tons. The total expenditure for this and its transportation was $1,125,600. This statement of costs is based on the expenditures from Federal funds and special additional expenditures by State and local agencies in carrying out the cooperative control work. It does not, however, include salaries of county agents and regular State employees who participated in the organization work, or the labor of farmers who distributed the bait.

The estimated value of the crops saved by these operations was $102,288,177, or a return of $51.78 for every dollar of expenditure. In addition, the control work made possible the harvesting of crops that would otherwise have been destroyed. In view of the vast areas infested, little effort could be made to do more than protect most of the cultivated crops. An offensive warfare against the hordes of grasshoppers hatching on range lands, public domain, or other extensive uncultivated areas was impossible. Owing chiefly to this fact, invasions of grasshoppers from such sources are estimated to have destroyed crops to the value of $65,827,215. The work of the season, however, gave proof that effective control can be obtained by baiting in accord with recommended methods; that, when applied as recommended, control measures can be used without injury to man, livestock, or wildlife; that best results are obtained when the work is done on a community basis; that efficient organization is necessary to obtain the best results; that provision should be made for control work on highways, right-of-ways, and uncultivated areas adjacent to crops; that plans should be made and announced early in the crop year and before grasshoppers have hatched; and that, where practicable, methods of control other than baiting should be used as auxiliary. The usual grasshopper survey, conducted in the fall of 1937, developed the fact that in addition to the 20 States involved in the campaign of 1937, four others, Idaho, Nevada, Oregon, and Washington, contained serious infestations and would have to be included in any plans for control in 1938. It was also shown that, in spite of the successful control campaign for the protection of crops waged in 1937, heavy intensifications of infestation had occurred in the Great Plains and Northern Rocky Mountain States. Estimates based on this survey indicated that, barring general weather changes unfavorable to hatching in the spring of 1938, the bait requirements for an adequate campaign would be not less than 180,000 tons, or practically twice those of 1937.

The results of the research work on grasshoppers during the previous 2 years proved most valuable in 1937 when, owing to an acute shortage in wheat bran, they permitted the adoption of a formula which had been tested previously and that substituted sawdust for an additional 25 percent of the bran previously used. It is estimated that by the use of this formula a saving of approximately $5 per ton of bait was made without apparent loss in effectiveness.

A revised edition of Farmers' Bulletin 1691, issued in April 1938, contained the most recent information regarding improved formulas for grasshopper baits, together with timely information on efficient methods of distribution.

Studies of the important species of range-infesting grasshoppers conducted in Montana demonstrated that, where these grasshoppers were present in numbers of 20 per square yard, they had destroyed no less than 67 percent of the range vegetation in 2 months' time. One of these, the long-winged grasshopper (*Dissosteira longipennis* (Thos.)), was the chief species injurious to crops in eastern Colorado, northeastern New Mexico, and the Panhandles of Texas and Oklahoma for the past two seasons, where it caused crop losses over wide areas. This emphasizes the importance of the present studies of range grasshoppers. Owing to the low intrinsic value of most of the lands concerned in this problem, poisoning for grasshopper control on them by present methods is not practical. It is hoped, however, that through a comprehensive study of the entire problem a method of handling such lands can be worked out which will result in eliminating or greatly diminishing outbreaks originating on such areas.

INSECTS ATTACKING CORN

Further improvement and simplification of methods of protecting sweet corn from the attacks of the corn earworm resulted from studies of the year. These results furnished alternative methods of protection, both of which promise satisfactory control for the earworm in early-market sweet corn and also for sweet corn grown in the home garden. One of these consists of the insertion in the ear tip, after pollination has occurred, of a machine-made tablet of hexachlorethane containing 0.5 gram, following which a simple wire clip is slipped over the silks and self-fastened. The gas generated within the ear kills any worms present and remains long enough to protect it from further invasion without injury to its flavor or otherwise. The alternative method is even more simple, consisting of the injection into the silks of a few drops of mineral oil of medical quality, and the subsequent placing of the wire clip. Extensive field tests are now being made of these methods, and it is expected that full directions for their use can be published at the close of the season of 1938. Applications for public-service patents on these inventions have been made to render them fully available for free public use.

During the protracted and extensive droughts that began in 1930, throughout the region inhabited by that strain of the European corn borer which has usually exhibited only a single generation annually, there was an apparent cessation in the rapid western spread of the insect which was an alarming feature of the period 1921–30. In 1936 significant increases in the rate of infestation were observed in southeastern Michigan and northwestern Ohio but a decrease in infestation was noted in southwestern Ohio counties. In 1937 there was not only a marked further increase in rate of infestation in southeastern Michigan and northwestern Ohio but also a distinct increase in the southwestern counties of Ohio and an extension of severe infestation into northeastern Indiana. In early sweet corn in Lucas County, Ohio, the infestation in 1937 reached an average of eight borers per plant, and reports received in the spring and early summer of 1938 revealed that there has occurred an alarming further increase in this area.

Serious injury to the corn crop by the corn borer in Indiana, Michigan, and Ohio is indicated for the near future unless vigorous control measures for the pest are at once renewed on a community basis.

In the region where the European corn borer produces two generations annually, extending from central New England along the coast southward to the Virginia Capes, similar intensification of infestation was recorded. Eastern Massachusetts, central Connecticut, southern New Jersey and Delaware, and the Eastern Shore of Maryland and Virginia are most heavily involved.

Progress in the development of strains and varieties of field corn exhibiting resistance to the European corn borer demonstrated that one of the crosses showing inherent resistance possesses a quality that serves to reduce the numbers of borers surviving on it, and that those borers which do survive become stunted and lack vitality to survive winter conditions. There is increasing hope that commercial varieties eventually will be produced which will assist materially in the control of this pest.

Methods were perfected during the year which will permit satisfactory control of the European corn borer on early-market sweet corn, where the margin of profit is sufficient to allow reasonable expenditure for control purposes. This consists of the application of sprays and dusts containing nicotine tannate, by the use of which it is possible to produce yields of sweet corn having 90 percent of the ears free from borers. This method is also applicable to sweet corn grown in the home garden.

INSECTS ATTACKING SMALL GRAINS

At the beginning of the growing season of 1937 the hessian fly was not numerous, and infestations were light or scattered in character. During the fall weather conditions proved more favorable for the insect, with the result that infestation increased rapidly in some localities.

The results of tests of 16 varieties of spring wheat with a view to the selection of those resistant to the hessian fly supported previous tests in that the varieties and selections previously exhibiting a high degree of resistance again showed much lower degrees of infestation than did those in the check plots. In similar tests of 51 selections of hybrid spring wheats in which deposition of eggs by the fly was very heavy, a number of these selections showed real promise of being materially fly resistant. In extensive tests of hybrids and selections conducted in cooperation with the Bureau of Plant Industry at La Fayette, Ind., out of 574 selections tested 91 showed conclusive evidence of resistance in the presence of heavy infestation, and have been reserved for further breeding work.

An experiment was begun in the fall of 1936 with hessian flies from California and Indiana, respectively, to determine the reactions of these strains of the insect toward certain differential varieties of wheat. The results thus far obtained indicate strongly that these flies represent different biological strains of the insect, since they reacted distinctly toward the test plants.

An extensive outbreak of the true armyworm occurred in the spring of 1937 in western Mississippi, southeastern Arkansas, and eastern Oklahoma. This afforded unusual opportunity for the comparison of control methods. In Mississippi more than 75,000 acres of winter oats was infested and much of this was dusted by the growers with calcium arsenate applied by airplane. Satisfactory results were obtained in this way where good coverage occurred with heavy doses of from 18 to 30 pounds of the insecticide per acre. Comparative large-scale tests made by Bureau investigators with the use of standard poisoned-bran bait showed that this method of control was, in general, considerably superior to dusting. Field studies of the degree of chinch bug infestation, made early in 1938, indicated that there had been a further recession in the general outbreak of the chinch bug that began in 1932 and reached its peak in 1934. The cool wet weather of the spring of 1938 throughout the Corn Belt apparently served further to repress the insect, and it is now apparent that the general outbreak has definitely waned.

INSECTS ATTACKING FORAGE CROPS

In experiments to determine the liability of transportation of the alfalfa weevil through commerce in hay, it was shown that a very small infestation of the weevil survived for a period of 8 months in baled native (Utah) grass hay. In alfalfa hay grown in a sparsely infested area in Idaho, and baled from haystacks in winter, small numbers of weevils survived for as long as 9 months. Weevils lived for nearly 7 months in experimentally baled hay stored under outdoor conditions, as contrasted with 3 to 4 months indoors as shown by the results of 1937. The female weevils surviving in such baled hay laid fertile eggs after being supplied with fresh food and being placed in a warm room.

A survey during June 1938 developed the fact that the alfalfa weevil had appeared in 12 new counties in 5 different States, viz, Douglas County, Oreg.; Big Horn County, Mont.: Big Horn, Hot Springs, Laramie, Park, and Washakie Counties, Wyo.; Banner and Kimball Counties, Nebr.; and Pitkin, San Miguel, and Weld Counties, Colo. The infestation in Weld County is of special interest, as it marks the appearance for the first time of the alfalfa weevil on the eastern slope of the Continental Divide in Colorado. During the year an extensive manuscript on the bionomics of the alfalfa weevil, which reviews in a comprehensive way the results of all the work with this pest to date, is being prepared for publication.

Experiments in the control of the potato leafhopper on peanuts confirmed the results obtained the year before, thus demonstrating that the application of dusts composed of copper and sulphur resulted in increased yields of from 30 to 60 percent of field-cured peanuts. The results of such work were published cooperatively as Bulletin 316 of the Virginia Agricultural Experiment Station.

INSECTS ATTACKING SUGARCANE

A survey made to determine the extent of injury by the sugarcane borer to the sugar crop of 1937 showed that 16.5 percent of the joints were bored as

compared with 8.7 percent in 1936. From nearly complete sugar-production figures it is estimated that through the work of this pest the growers lost sugar to the value of $3,583,000.

Experiments made with a view to breeding varieties of sugarcane that may exhibit resistance to attacks of the borer indicated that a New Guinea variety, introduced by the Department in recent years, may be of value as a parent cane in breeding for resistance to the borer.

Recovery was made of a tachinid parasite of the sugarcane borer introduced from Cuba in 1936 at Grand Isle, La. It was found that the rate of parasitization at that time was 11 percent. Whether or not this record indicates permanent establishment can be determined only by subsequent observation.

Recent studies with cryolite applied as a dust for the control of the sugarcane borer gave considerable encouragement. It was found that the untreated plots contained from 8 to 10 times as many borers as those treated with the insecticide.

INSECTS ATTACKING STORED GRAINS

Many millers depend on chloropicrin, or tear gas, for the periodic fumigation of individual machinery units. Tests of this gas under actual commercial conditions, conducted by Bureau experts, have shown that doses up to 1½ pounds per unit killed all adults of the flour beetle but failed to kill most of its eggs. As a substitute for this it was determined that a mixture of ethylene dichloride 75 percent and carbon tetrachloride 25 percent gave equally good kills of adults and larvae and far better kills of the eggs. It is much less disagreeable to use and costs only one-eighth as much as chloropicrin.

The preservation from the attacks of insects of rough rice in storage has long been a serious problem. Most of this product is stored in loosely constructed warehouses and mills throughout the Gulf or Southern States. The rice becomes somewhat infested with insects before harvest; and this infestation, when carried into storage, increases rapidly under the prevailing mild and moist climatic conditions, frequently causing an immense aggregate loss to the growers and processors of the grain. Observations were made during the year on the fumigation, under atmospheric pressure, of 2,500,000 pounds of rough rice stored in a tightly constructed warehouse having a capacity of 100,000 cubic feet.

The rice was fumigated with liquid hydrocyanic acid at a dose of 1¾ pounds per 1,000 cubic feet of space, applied at a temperature of 80° F. for a period of 72 hours. This resulted in a complete kill of all stages of the insects; thus indicating that, when stored in suitable buildings, the fumigation of rough rice is perfectly feasible.

Further experiments with borax as an insecticide for application to rough stored rice developed the fact that, although it killed most of the insects, the boron was adsorbed by the grain in sufficient quantities to render its use undesirable.

A new and valuable method of fumigation for clean rice was discovered. The atmospheric fumigation of stored rice with hydrocyanic acid gas has not heretofore proved successful because the outer portions of the mass absorb much of the gas. A relatively expensive method of fumigation under vacuum has therefore been used to control the insects in this commodity. It has now been found that by spraying the grain stream with liquid hydrocyanic acid as it moves into a closed tank or container, so that the fumigant reaches all the grain, all insect life in it is killed. This discovery should result in large savings to millers and processors of rice throughout the South.

Loss from insect attack on cattle feed held in storage is often heavy. Studies of a practical method of fumigating such feeds in a vault under atmospheric pressure have demonstrated that an application of 7½ ounces of liquid hydrocyanic acid per ton of feed killed all insect life in sacked feed when this was left undisturbed for 48 hours after fumigation was finished.

A study, in representative mills of the Middle West, of the methods used to re-dress flour revealed that there was lack of uniformity in the methods used, and that a few mills were using systems capable of removing insect infestations from finished flour. Contamination was found to originate from blending of returned flours, blending in of purchased or stored clear flours, the use of reels instead of sifters in re-dressing flours, and the location of conveyors, chlorine agitators, and elevators between the re-dress machinery and the packer bins. To obviate these faults, a model system of handling flour was outlined and published during the year.

WHITE-FRINGED BEETLE CONTROL

When the white-fringed beetle was discovered recently in the Gulf States it was recognized as a possibly serious pest. Parthenogenetic in its development, prolific in reproduction, feeding on a wide variety of plants, diverse in methods of distribution, and not vulnerable to attack at any point in its life history, this insect presented a serious problem in control when this project was started in July 1937.

Though the infested area is probably not delimited as yet, the white-fringed beetle is known to occur in the counties of Escambia, Okaloosa, and Walton in western Florida; in the counties of Covington and Geneva in Alabama (though in the first few days of July 1938 it was found in Conecuh, Mobile, and Monroe Counties, Ala.); in the counties of Covington, Harrison, Jackson, Jones, and Stone in Mississippi; and in three parishes in the immediate vicinity of New Orleans, La. To determine the infested areas was an active part of the program during the year. A five-phase survey plan was developed in the current season involving regular personnel and volunteers. Work by the regular personnel consisted of (1) intensive inspection of known areas to determine outer limits, (2) extensive surveys in infested States to find outlying infestations, (3) spot inspections in neighboring States and more remote areas of infested States for chance discovery of possible incipient infestations, and (4) inspections by State pest-control officers of planting points or destinations of shipments of nursery stock, made during the past 3 years, from nurseries now known to be infested. These shipments went to 44 States and the District of Columbia. Work by volunteers contemplated the cooperation of Boy Scouts, Future Farmers of America, county agricultural agents, home demonstration agents, and garden clubs. Splendid cooperation was given. A taxonomic unit was established at Gulfport for determination of specimens submitted by survey personnel.

Large-scale experiments in control methods were conducted in the original known infested areas. The use of calcium arsenate dust on foliage kills enormous numbers of beetles. Dust-mulch furrows and post-hole traps show promise under certain conditions. Clean cultivation, burning of plants, and weed-killing sprays on foliage contribute to starvation. Precipitation presents a difficult factor in the use of some of these methods.

The shipping of many products, such as lumber, nursery stock, cotton, cottonseed, soil, etc., from the infested area presents serious difficulties on the control of spread of the pest. Efforts are being made to determine the practicability of fumigation of products to permit movement from the area.

Full cooperation is being afforded by the infested States toward inspection, control, and prevention of spread. State quarantines and local ordinances are in force regulating the production and movement of products liable to encourage or distribute the pest. Local W. P. A. projects are assisting materially in control operations.

MORMON CRICKET CONTROL

Federal funds were allotted for the control of Mormon crickets from appropriations for the control of incipient and emergency outbreaks of insect pests and plant diseases. The control program was designed on a crop-protection basis, in which Federal, State, and local governmental agencies could cooperate in furnishing supervision, materials, transportation, and labor.

Field headquarters were established at Salt Lake City, Utah, and understandings were developed with States, counties, and communities in which infestation occurred as to the basis of cooperation and the responsibilities of all interested agencies. Federal funds were to be used for supervision, the employment of labor, the purchase of light dusting machines when necessary, and the furnishing of dusting materials and oil as an offset to locally furnished equipment or labor. Cooperating States were to furnish additional technical and supervisory personnel, transportation for labor, materials, and equipment, and mixing and storage plants, and additional dust materials and oil. Over 150 power-dusting machines were purchased by communities and individuals.

The peak of control operations was reached late in June, when over 950 laborers were employed by the Bureau in infested areas. Work was conducted in the States of Colorado, Idaho, Montana, Nevada, Oregon, South Dakota, Utah, Washington, and Wyoming.

Barriers of various types were used to stop the crickets in their march from breeding grounds in mountainous or waste areas to agricultural land. Metal

strips 10 inches high, totaling 185 miles in length, were repeatedly erected, and traps were constructed at intervals along this barrier to catch the crickets. Fifty-six miles of earth barrier were erected, and oil films were maintained on 338 miles of available streams and irrigation ditches to kill crickets attempting to cross.

When crickets were "bunched" or were on the march, sodium arsenite dust was applied on them with hand or power dust guns. By the close of the year more than 150,000 acres had been dusted in the control campaign of 1938, and despite heavy migrations from breeding grounds to agricultural lands exceptionally fine control was effected with these methods. On nonagricultural land in some areas trees, shrubs, and small native plants were severely injured. Cattle were reported to be leaving infested range land because the range was denuded by crickets.

EUROPEAN CORN BORER INSPECTION AND CERTIFICATION

Federal inspection and certification continued with the personnel necessary to fulfill State requirements prescribing that host material likely to spread the European corn borer must bear Federal certification before entry into Arizona, California, Colorado, Georgia, Louisiana, Nevada, Oregon, Texas, and Utah. The major portion of the work was performed in conjunction with inspection activities under the Japanese beetle and gypsy moth quarantine regulations.

With the increase in corn borer population in several extensive dahlia-growing sections of southern New Jersey, more detailed inspection of individual lots of dahlia tubers was required beyond the regular field scouting to determine presence or absence of the borer in dahlia plantings. Lowered production and poorer-quality tubers were in some instances attributed to heavy borer invasion.

Inspectors issued 21,460 certificates authorizing the movement of plant material having an estimated value of $199,000. The volume of work closely paralleled that of the previous year.

BLACK STEM RUST QUARANTINE ENFORCEMENT

An important change in the black stem rust quarantine, effective September 1, 1937, was the addition of the States of Missouri, Pennsylvania, Virginia, and West Virginia to those previously designated as protected. This action was taken at the request of the four States concerned and in consideration of the rather extensive eradication of rust-spreading barberries carried on in these States. Nurserymen in various parts of the United States may be supplied with Federal permits authorizing the shipment of immune species of barberries and mahonias into any one of the 17 protected States. Such permits are issued only for nurseries where, as determined by inspection, none other than rust-resistant species are grown. During the year such permits were issued to 34 nurserymen and 1 dealer. The Japanese barberry (*Berberis thunbergii*), an immune species, and its horticultural varieties, are exempted from the quarantine requirements. Twenty-five other species of barberries have been determined as eligible for shipment to the protected States under permit.

BARBERRY ERADICATION

The number of rust-spreading barberry bushes in Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and Wyoming has been greatly reduced since 1933, when the first of several allotments of funds appropriated for the relief of the unemployed became available to the Bureau for the expansion of field operations in connection with this and similar projects. There are more than 100 species of barberry in the United States that are susceptible to attack by the fungus causing stem rust of wheat, oats, barley, rye, and many native grasses.

During this period an intensive survey has been made of all uncultivated lands in more than 350 counties, and all barberry bushes found have been destroyed. Known areas of infestation have been brought under control in an additional 240 counties. As the eradication program progresses, all infested areas found are carefully mapped, affected properties recorded, and counties in which the work has been completed are classified by townships with respect to future survey needs. Of the 980 counties making up the 13 States com-

prising the original control area, progress maps for 946, showing the present status of control operations, have been completed, and copies are now on file in the Washington office. About one-half of these have been prepared on the basis of results of control work conducted prior to the time that emergency funds became available. When another more intensive survey is completed in these counties, revised progress maps will be prepared.

In Montana, Wyoming, North Dakota, South Dakota, eastern Colorado, and western Nebraska known infestations are now under control, and it is expected that there will be little need for the extensive use of labor after the close of the next field season. Results of control work conducted in these States during the past 3 years indicate that the remaining bushes are widely scattered, and plans for a maintenance program are now being considered which will provide for reinspections in areas where bushes have been found, the location of those missed during previous surveys, and continuation of an annual rust survey to determine localities in which prevalence of stem rust indicates the presence of bushes.

In eastern Nebraska, southwestern Colorado, Iowa, Minnesota, and States east of the Mississippi River the program is not so far advanced, and there are many known areas of infestation needing attention just as soon as available funds will permit.

In addition to work completed in the States listed, a vigorous program has been continued in the more important grain-growing counties in Missouri, Pennsylvania, Virginia, and West Virginia, where extensive eradication programs were first undertaken in 1935. In Pennsylvania and the Virginias the topography, weather conditions, and other factors are such that stem rust may be controlled locally by removing barberry bushes from uncultivated lands in and immediately adjacent to important grain-growing communities. In these States farmers are taking an active part in the eradication of bushes on and near their own properties.

Table 8 summarizes the progress in barberry eradication during the year. In analyzing the tabular information, it should be kept in mind that figures for Virginia, West Virginia, and Colorado are hardly comparable with those of other States in the control area, as much of the work conducted in these States during the year has been in areas where native species of barberry are prevalent. *Berberis fendleri* in Colorado and *B. canadensis* in the Virginias grow in patches, often several rods in diameter, which accounts for the relatively large numbers of bushes destroyed in these States.

TABLE 8.—*Progress of barberry eradication during the fiscal year 1938*

State	Territory surveyed	Properties cleared	Bushes destroyed	Salt used
	Square miles	*Number*	*Number*	*Tons*
Colorado	564	114	1,948,351	64.94
Illinois	3,890	200	7,420	6.07
Indiana	3,325	61	342	.86
Iowa	5,503	381	21,707	37.11
Michigan	2,634	437	231,615	104.17
Minnesota	7,749	220	2,266	23.20
Montana	1,100	10	866	.35
Nebraska	3,700	56	410	1.68
North Dakota	1,700	8	641	.92
Ohio	3,250	256	48,575	56.68
South Dakota	1,702	13	25	.06
Wisconsin	1,120	260	86,962	93.41
Wyoming	280	3	3	0
Total	36,517	2,019	2,349,183	389.45
Missouri	1,875	49	493	.55
Pennsylvania	1,388	1,095	4,160,788	548.34
Virginia	113	374	9,666,586	582.62
West Virginia	147	207	15,975,812	975.79
Total	3,523	1,725	29,803,679	2,107.30
Grand total	40,040	3,744	32,152,862	2,496.75

DEVELOPMENT OF STEM RUST IN 1937

Extensive observations were made during the year to determine the source of inoculum causing the widespread stem rust epidemic in 1937. From a comparatively limited number of urediospores overwintering in Texas, and possibly some migration of spores from southern Mexico, stem rust multiplied rapidly early in May in northern Texas, where grain crops were heavy and succulent. Under wind and moisture conditions favorable to rust development, the epidemic spread northward and eastward as the season advanced. In the winter-wheat area there were heavy losses in certain sections of northern Texas and part of northeastern Oklahoma, eastern Kansas, Missouri, central Illinois, and south-central and southwestern Ohio. Farther north, in the spring-wheat region, the epidemic reached its greatest intensity in northeastern South Dakota, southeastern North Dakota, and west-central Minnesota.

During the year 1,117 aecial and uredial collections obtained in the United States and northern Mexico were identified. From those collected in the United States 22 different physiologic races of the stem rust fungus were isolated and 13 were identified from collections made in Mexico. Race 56 was by far the most prevalent in the United States. It comprised 55.7 percent of all isolates. Race 38, the next most prevalent, comprised 8.7 percent of all identifications. Races 11 and 49 were about as common as 38. Others identified included races 17, 36, 19, 34, 57, and 146. Race 34, which was one of the most prevalent several years ago, constituted only 1.1 percent of the isolates made this year. Race 57 had been found only once previously, and that was in 1929. Race 146, found for the first time in 1936, was again identified from collections made this year.

On the basis of complete rust surveys, such as those made in recent years, and prompt identification of prevalent forms, it is possible to determine several weeks in advance the varieties of grain that are likely to be severely attacked by stem rust, allowing, of course, for the influence of weather conditions.

Marquis and Ceres, two varieties of hard red spring wheat, are highly susceptible to race 56. Thatcher, a new spring wheat variety, is highly resistant to race 56.

SPECIES OF BARBERRY SUSCEPTIBLE TO ATTACK BY THE STEM RUST FUNGUS

Studies to determine the susceptibility of unclassified species of barberry were conducted under controlled conditions at St. Paul, Minn., and under field conditions at the Foreign Plant Introduction Garden, Bell, Md.

An exceptionally good test of more than 150 species of barberry was obtained this year at Bell, Md. Conditions were such that an abundance of infection resulted from inoculations and, with the follow-up work to be done under greenhouse conditions, many species heretofore considered questionable will be definitely classified, by the close of this field season, as either resistant or susceptible.

The results of susceptibility tests conducted during the last 4 years have established 102 species as definitely susceptible when inoculated under outdoor conditions, and 31 species as sufficiently resistant or immune to be considered safe for propagation or distribution within the protected States. Species that have been determined as definitely resistant or definitely susceptible will be removed from the test plots before inoculations are made next year. Type specimens of each species collected from anywhere in the United States will be retained in a barberry garden for observation in connection with taxonomic studies.

THIRTY-THREE NURSERYMEN GRANTED PERMITS TO SHIP BERBERIS INTERSTATE

During the summer and fall of 1937, 46 eastern and midwestern nurserymen planning interstate shipment of immune species of *Berberis* and *Mahonia* (other than *Berberis thunbergii*) made application for the required inspection of their properties. Rust-susceptible barberry plants to the number of 2,870 were destroyed during the course of the inspection work, which involved more than 10,500 acres of nursery stock. Thirty-three nurserymen fulfilled the requirements of quarantine No. 38 (revised) and were granted interstate shipping permits by the Division of Domestic Plant Quarantines. Nine failed to qualify, and no action was taken in the case of four pending further clean-up

work. During the year the Bureau received for identification, through the mail, more than 150 specimens of *Berberis* from various parts of the country.

A recent survey of nursery catalogs on file in the Department library indicates that fewer than 40 nurserymen throughout the United States are now advertising susceptible species of barberry for sale.

Accurate identification of barberries encountered by Federal quarantine inspectors, State nursery inspectors, and eradication supervisors is essential in connection with the proper administration of quarantine No. 38 (revised), the object of which is to prevent, through education and regulation, the interstate movement of susceptible species of barberry into or between States comprising the protected area.

CHEMICAL ERADICATION OF NATIVE SPECIES OF BARBERRY

As a result of tests conducted on 1-square-rod plots infested with *Berberis fendleri* and *B. canadensis* in Colorado and West Virginia, respectively, it was found that 85 to 100 pounds of evaporated salt dissolved in water and applied as a spray and soil drench was sufficient to give a 99 to 100 percent kill. During certain months of the year, and under certain soil conditions, quantities ranging from 60 to 75 pounds per square rod proved sufficient. In actual field practice, however, at least 85 pounds per square rod is needed to insure complete eradication, and 90 to 100 pounds is used in loose, sandy soil and on hillsides where the results of the treatment may be affected by rapid leaching of the salt.

EDUCATIONAL WORK ACCOMPANYING CONTROL OPERATIONS

Information concerning barberry eradication released to the public during 1937 was restricted largely to brief illustrated circulars, news items in local papers, circular letters, and frequent reports on the occurrence and spread of rust during the critical stage in the development of grain crops.

The purpose of the educational work is to advise property owners with respect to the nature of the stem rust disease and the recommended control measures, to stimulate property owners to keep their farms free of rust-susceptible barberry bushes once the initial eradication work has been completed, and to encourage reports of badly rusted grain fields or areas known to be infested with barberry bushes as a guide to communities in which survey work is urgently needed.

Statements based on observations made by Bureau representatives relative to the development and spread of stem rust were submitted to the Department Press Service weekly during the growing season. The first of these related to the first appearance of stem rust in grain fields in northern Mexico and Texas. Later reports dealt with the development and northward spread of rust through the winter wheat belt and into the spring wheat States.

TRUCK CROP AND GARDEN INSECT INVESTIGATIONS

WIREWORMS

The investigations of wireworms occurring in irrigated lands were continued in eastern Washington, southern Idaho, and southern California. These investigations consisted principally of studies of the utility of crude naphthalene as a practical control for wireworms, the further testing of dichloroethyl ether under field and laboratory conditions, studies of the effect of crop rotation on wireworm populations, and studies of the effect of time of planting of potatoes on wireworm populations and the habits of wireworms, both larvae and adults, which may have a direct bearing on control measures. The field experiments with crude naphthalene were carried out by applying different quantities of the material at different periods of the season. These experiments show that it is practical to fumigate with naphthalene as early as the latter half of May in the eastern Washington area. At the present time it would appear that the greatest use of crude naphthalene in that area is in the reduction of heavy infestations to the point where the more susceptible crops can be grown with a high degree of freedom from damage. It is evident that the type of soil has a very definite bearing on the penetration of the naphthalene vapor and the resultant wireworm kill.

A typical example of the effect of alfalfa on wireworm populations is shown in a field that had been in alfalfa for 5 years. Prior to the planting of alfalfa

the population in this field averaged eight per square foot. During the spring of 1937 one-half of the field was planted to potatoes and the other half to onions. An examination of the onion and potato fields showed that in the potato field there was less than one wireworm per square foot and less than 4-percent damage to the potato tubers, and that in the onion field the wireworm population averaged a little more than one wireworm per square foot and the damage was approximately 11 percent to the onion crop.

The tests with dichloroethyl ether in California disclosed that aqueous solutions of this material diluted at the rates of 6, 9, and 12 cubic centimeters per gallon gave a mortality ranging from 67 to 100 percent of the wireworms. These solutions were applied to tomato, corn, cabbage, and potato plants. No detectable plant injury resulted to any of these crops except in instances where the 12 cubic-centimeter dilution was applied at a dosage of 1 gallon per plant.

BEAN AND PEA INSECTS

MEXICAN BEAN BEETLE

Insecticidal tests[1] for the control of the Mexican bean beetle were conducted in Ohio, Virginia, and Colorado.

Field experiments in Ohio and Virginia on beans grown for the green-bean market or for canning showed conclusively that this pest can be satisfactorily controlled by the use of sprays or dust mixtures containing rotenone derived from derris, cube, timbo, or devil's shoestring. Cryolite sprays gave satisfactory control in most instances. Copper cyanide gave a fair degree of control of the insects, but moderate plant injury resulted. Fairly satisfactory results were obtained with the new insecticide sulphur nitride, particularly when it was milled in such a manner as to produce fine particles. Experiments with mechanical equipment demonstrated that the use of hoods attached to power dusters permitted a reduction in dosage of the insecticide without causing any reduction in the degree of control.

In Colorado the results from tests on irrigated beans grown for the dry-bean market demonstrated that sprays containing derris and cube gave better results than any other materials tested, and that cryolite sprays gave the next best results. Also, that sprays containing zinc arsenite, commonly used by the growers in that district, were third in rank according to the degree of control of the Mexican bean beetle obtained with these insecticides.

PEA WEEVIL

Biological and control investigations on the pea weevil as a pest of processed and dry peas were continued in the Northwest in cooperation with the States of Washington, Oregon, and Idaho and interested growers, with gratifying results. The large-scale field experiments in the Blue Mountain area of eastern Washington and Oregon, in which dust mixtures containing rotenone were applied, yielded favorable results, as was the case last season. Comparative treatments showed that the use of hoods on large dusting machines increased the efficiency of these dust mixtures. No apprecable differences could be detected in the percentage of pea weevil control obtained with dust mixtures containing 1 percent as compared with those containing 0.75 percent of rotenone when the quantities of the dust mixture applied per unit area were practically equivalent. The results, however, indicated that under unfavorable climatic conditions or other restricting factors the dust mixtures containing less than 0.75 percent of rotenone might give a satisfactory degree of control. In the case of large acreages, the practice af treating border strips was followed to protect the rest of the field. In some instances "spot dusting" was practiced to reduce infestation. In the western Oregon and Washington pea-growing area where the pea fields are in smaller units, the entire field was treated, and infestation of the weevil was reduced to a minimum.

Additional numbers of the imported pea weevil parasite *Triaspis thoracicus* (Curt.), comprising approximately 20,500 living adults, were released in Idaho in 2 situations and under conditions that would appear favorable for establishment of this parasite. Although these parasites originated in Europe and were

[1] Samples of the rotenone-bearing materials, pyrethrum, and fluorine compounds used in all the experimental control work discussed in this report were analyzed by the Division of Insecticide Investigations of this Bureau, and the dilutions were based on these analyses.

reshipped to Moscow, Idaho, from Moorestown, N. J., they were received in Moscow in excellent condition and suffered a mortality of only approximately 5.7 percent of the numbers contained in the original shipment. Field collections to determine whether this parasite has become established in Idaho have yielded negative results thus far.

PEA APHID

During the springs of 1937 and 1938 the pea aphid was particularly troublesome in Maryland, Delaware, and New Jersey. Investigations were continued in Wisconsin on the control of this pest. In these control tests emphasis was placed on the time of treatment for maximum benefit in protection of the crop. Field and laboratory tests were continued with derris and cube dusts and sprays and the results show that these materials, applied either as a spray or a dust, appear to be the most satisfactory ones developed thus far for the control of this aphid. Adequate spraying or dusting equipment is essential to aphid control, as is proper material and time of treatment. A joint statement on pea aphid control, prepared by the workers in the several States where this insect is an annual problem and by Department entomologists, has been issued.

CORN EARWORM ON LIMA BEANS

Results of experiments conducted in Virginia to determine the relative effectiveness of various insecticides for the control of the corn earworm on Fordhook lima beans revealed that dust mixtures and sprays containing cryolite continue to be the most effective materials for the control of this pest. Of the three commercial brands of cryolite used in the experiments, imported synthetic cryolite and natural cryolite appear to be about equal in effectiveness, both brands being slightly more effective than the brand of domestic synthetic cryolite used in the experiments.

TOMATO INSECTS

TOMATO PINWORM

Investigations were continued on the tomato pinworm in California and the tomato fruitworm in California and Utah. The tomato pinworm continued to cause serious losses to the tomato crop in southern California and enlarged its known area of distribution to include Arizona. The results of tests during 1937 corroborated the fact that cryolite and cuprous cyanide, in either sprays or dusts, were the most effective stomach poisons used against this pest. Contrary to former belief, both cryolite and cuprous cyanide protected the treated plants effectively for a period of approximately 60 days following the last application. Large-scale field tests demonstrated that two applications of a spray or a dust mixture gave sufficient protection from a relatively light pinworm infestation, whereas five applications were required in fields where infestation was heavy. It was determined that to obtain best results applications should begin when the pinworms start forming leaf folds on the plants. During laboratory tests on tomato plants grown in pots and infested by the pinworm it was disclosed that the toxicity to this insect of a commonly used brand of natural cryolite increased, as the dilutions of cryolite increased, from 10 to 60 percent. At a 10-percent dilution approximately 69 percent of the pinworm larvae were killed, whereas at the 40-percent dilution approximately 97 percent perished. There was a distinct leveling off of the mortality curve at the 40-percent dilution. The toxicity of cuprous cyanide to the pinworm larvae also increased at progressive dilutions of 5, 10, 15, 20, and 30 percent. At dilutions below 30 percent pinworm mortality was less than 90 percent of the individuals tested.

TOMATO FRUITWORM

During 1937 work on the tomato fruitworm (*Heliothis obsoleta* (F.)) was continued with particular attention to control tests as well as biological studies designed to give information respecting the habits of the insect which have a bearing on its control. In California the most satisfactory insecticide found for use in combating the fruitworm was a dust mixture of equal parts by weight of cryolite and talc. Fairly satisfactory results were obtained with cryolite sprays at the rate of 4 pounds to 100 gallons of water, plus a suitable sticking agent, and with phenothiazine at the rate of 3 pounds to 100 gallons

of water. The best degree of control was obtained with the above-mentioned insecticides when three applications were made. The first application was made when the foliage of plants measured about 1 foot across and the second and third applications followed at about 2-week intervals, 10, 20, and 30 pounds, respectively, being used per acre. A bait prepared by thoroughly mixing 1 pound of cryolite or lead arsenate with 25 pounds of corn meal was approximately as effective as the dust mixture described previously. This bait was applied by hand, and an attempt was made to scatter it lightly and evenly over the leaves of the plants. Three applications of the bait were made corresponding with the time interval indicated for the dust mixtures. Approximately 40 pounds of the poisoned bait was used per acre for each of the first and second applications and from 60 to 70 pounds for the third application. The cost of the bait per acre is approximately the same as for the dust mixture, but the ease and speed of application without the use of special equipment met with general favor on the part of the growers.

SWEETPOTATO WEEVIL

The work on the sweetpotato weevil was expanded with research laboratory headquarters at Sunset, La. Biological and life-history investigations were initiated with special reference to those phases of the insect's life history and habits which would yield information pertinent to the control program on this pest. It was determined that when the sweetpotato weevil adults were given the opportunity to choose between young sweetpotato plants and sweetpotato roots, the adults fed almost exclusively on the roots, and all the eggs were deposited therein. In a series of field cages simulating natural conditions at two widely separated points in Louisiana during the winter of 1937–38 it was found that certain adults of the sweetpotato weevil lived as long as 118 days without food during the period extending from late in November to the latter part of March whereas other individuals lived as long as 86 days. In cages placed over green sweetpotato vines certain weevils lived for 92 days. The cages in question were placed in position in the fall of 1937 in the latter part of the sweetpotato harvest season and before the fields were cleaned. In general it was found that access to food prolonged the life of adults in the field. There was no appreciable difference in the adult survival between cages protected from direct precipitation and those exposed to precipitation.

While only a small percentage of the total adults used in these tests lived throughout the winter period without food, it appears that this phenomenon may occur in any season in southern Louisiana when conditions are favorable. Adults of the sweetpotato weevil emerged during March from decayed sweetpotatoes that had been exposed on the soil surface of infested fields in Louisiana from the time of harvest during the fall of 1937 to late in February 1938, at which time they were collected for observations on adult emergence. The fact that the adults of the sweetpotato weevil were able to survive under such conditions demonstrates the danger of leaving infested decaying sweetpotatoes in fields or storage banks where they may become a source of weevil reinfestation.

Observations in Louisiana to determine the results of the fumigation of weevil-infested seed sweetpotatoes in storage houses, bins, and banks by paradichlorobenzene, a chemical the use of which has been the subject of previous reports, showed that wherever the fumigation was performed properly the results were satisfactory.

EUROPEAN EARWIG

Encouraging results were obtained in the recovery of *Bigonichaeta setipennis* (Fall.), the imported parasite of the European earwig, in Washington, Idaho, and Oregon. During the 4-year period 1934–37 this parasite has been liberated at 20 different points in these States. Recovery records at the close of 1937 indicated that it has survived at or near 15 of the colony sites. It is believed that it has been definitely established at the larger number of these colony sites, even in localities where the original liberation consisted of as few as 10 to 25 adults.

COLE-CROP INSECTS

Work on various species of worms attacking cabbage was continued in North Carolina, South Carolina, and Louisiana and on the turnip aphid in Louisiana. Investigations on cabbage worms attacking cabbage in Louisiana

and South Carolina continued to yield valuable information on methods of control. Results of insecticide tests directed against cabbage worms on cabbage grown in South Carolina during the fall and winter showed that a cabbage worm population consisting of the cabbage looper and various Agrotinae (principally the corn earworm and several species of climbing cutworms) can be controlled by the use of calcium arsenate-hydrated lime dust mixture (5 to 1) prior to the heading of the plants, followed by applications of a pyrethrum-talc dust mixture containing 0.3 percent of total pyrethrins, or a derris-clay dust mixture containing 1 percent of rotenone, at 10-day intervals after the plants have headed. While no significant differences were demonstrated between the yield of U. S. Grade No. 1 from the various treatments, highly significant correlations were shown to exist between the numbers of worms and the numbers of worm-damaged plants and, in the reverse ratio, between the numbers of worms and the numbers of plants free from worm injury. These experiments demonstrated again that the dust mixtures containing pyrethrum or derris were the ones most effective against the cabbage looper and that the calcium arsenate dust mixture was the one most effective against the Agrotinae.

The results of a survey of conditions relating to cabbage and cabbage worms in Louisiana indicated that the cabbage looper, the imported cabbage worm, and the larvae of the diamondback moth constitute 95 percent or more of the worm populations found on cabbage in that State, and that their relative importance is in the order named. It was found that the cabbage looper was the dominating factor on fall crops and that it appears late on spring crops. The imported cabbage worm was the most important, if not the most abundant, species on spring crops and ordinarily appears later on fall crops in damaging numbers. The larvae of the diamondback moth may become abundant on either the spring or the fall crop. The cabbage webworm, the cross-striped cabbage worm, and several species of Agrotinae are abundant on fall crops.

Studies in South Carolina on the seasonal occurrence of the principal species of cabbage worms on cabbage disclosed that the imported cabbage worm, the larvae of the diamondback moth, the cabbage looper, and several species of cutworms are more abundant during the spring months than during the fall and winter; that the populations of these species decrease to a marked degree during the fall when the mean temperatures are below approximately 50° F., and that they do not increase greatly in the spring until the mean temperatures are consistently above 60°; and that after the plants are thinned or transplanted the cutworms and the cabbage looper are the most abundant species during the fall months and the cabbage looper and the diamondback moth the most abundant during the spring. These studies also revealed that approximately two generations of each of the major species of cabbage worms developed during their more active periods in both the fall and the spring seasons.

BERRY INSECTS

Further tests against the strawberry weevil in the coastal regions of North Carolina indicated that a calcium arsenate-sulphur dust mixture remains the best available insecticide to use against this pest, since it greatly reduced the injury to fruit buds and gave an increased yield in the number of marketable fruits and culls. A dust mixture containing sulphur and hydrated lime also gave promising results in the reduction of injury to fruit buds, and resulted in an increase of marketable berries as compared with untreated plots. In a survey performed during the spring of 1938 in the strawberry districts of the Eastern Shore section of Maryland and in adjacent counties of Delaware and Virginia it was found that in the fields examined a range of from 16 to 81 percent of strawberry buds were cut as a result of strawberry weevil activity in fields examined in Sussex County, Del., from 17 to 67 percent of the buds were cut in three counties of Maryland, and a range of from 3 to 63 percent of the buds were cut in Accomac County, Va. In many fields the prevalence of drought and other unfavorable factors prevented the strawberry plants from developing the remaining uncut buds; consequently it was difficult to determine the exact economic status of the strawberry weevil in such fields.

Continued insecticide tests against the raspberry fruitworm in the Puyallup Valley, Wash., showed that satisfactory control of this pest could be obtained with three timely applications of sprays or dust mixtures containing rotenone, and that in general the sprays were superior to the dust mixtures in controlling the fruitworm.

Continued experiments in the control of the red berry mite (*Eriophyes essigi* Hassan) on blackberry in the Puyallup Valley demonstrated that following a spraying with lime-sulphur during the dormant period of the plant the application, during the fruiting stage of the berries, of sprays containing emulsions of refined petroleum oil was superior as a control for the mite to the application, when the fruit spurs were approximately 12 inches long, of sprays containing various compounds of sulphur. Despite the fairly satisfactory control obtained with sprays containing sulphur, the application of such materials caused reductions in yield of berries apparently due to the intolerance of the blackberry plant to sulphur. Some evidence also was obtained that the oil emulsions used in the sprays, although exerting a satisfactory control of the mite, caused reductions in yield through injury to the plant.

BEET LEAFHOPPER

Investigations on the beet leafhopper were continued in the intermountain region and in California. For the second time the migration of this insect was traced definitely from its breeding areas in southern Arizona to the western Colorado beet fields, indicating that this long-distance migration may be a normal annual occurrence.

Experiments, in cooperation with the beet-seed producers, having for their principal object the checking of the curly top disease in the beet plantings grown for seed in the Salt River Valley of Arizona demonstrated again that the pyrethrum-oil spray when atomized on the beets in the field will kill on an average approximately 97 percent of the leafhoppers.

In Idaho close attention was given to the development of the leafhopper in the desert area surrounding the cultivated sections, with the view of ultimately determining all factors responsible for favorable or unfavorable beet leafhopper conditions. Statements on the movements of the leafhopper from the desert area to the cultivated sections were prepared and made available to the beet and bean growers in the affected area. These statements simply give the facts on the leafhopper conditions as they obtain in the area at the time the statement is prepared, and there is no attempt to make predictions as to beet leafhopper infestations on the basis of overwintering leafhopper populations.

In Utah attention was directed to the development of means of protecting the tomato crop from leafhoppers and the resultant western yellow blight. It was found that the tomato is not a suitable host for the leafhopper although the leafhopper feeds occasionally on tomatoes during its movement from the desert host plant to suitable cultivated plants.

The surveys made in the Billings, Mont., district disclosed the presence of adult beet leafhoppers, indicating that during certain winters this insect is able to survive in this section of Montana.

In California the movements of the leafhoppers from the overwintering areas in the hills adjoining the San Joaquin Valley were followed again this season. The information accumulated on this phase of the study indicates strongly that if these critical breeding areas could be eliminated, or the leafhoppers killed through spraying or other similar treatments, this would reduce to a minimum the leafhopper damage in the San Joaquin and Sacramento Valleys, as it was definitely shown that the leafhoppers originating in the foothills of the San Joaquin Valley are responsible for damage in the Sacramento Valley.

TOBACCO INSECTS

TOBACCO FLEA BEETLES

Investigations on tobacco insects were continued in Connecticut, Florida, North Carolina, South Carolina, Tennessee, and Virginia. Field-plot tests and large-scale field experiments against flea beetles (*Epitrix parvula* (F.) and *E. cucumeris* Harr.) in Florida, Tennessee, North Carolina, South Carolina, and Connecticut corroborated the results of tests performed during previous years in indicating that wherever the value of the crop justified the use of this insecticide these pests could be controlled in the plant bed, as well as on newly set plants and on the growing crop, by timely applications of a dust mixture containing rotenone. Since the newly set plants are very susceptible to injury by the tobacco flea beetle (*Epitrix parvula*) in the areas of flue-cured tobacco, extensive tests were carried on to determine the most satisfactory method of protecting them after they were set in the field and until they had become well established. Treatment of the plants in the plant bed with arseni-

cals directly before they are pulled for setting in the field and treatment of the plants with the same materials after they are set in the field indicated quite clearly that these methods could be utilized to a distinct advantage in the protection of the newly set plants. As a result of quantitative sampling of hibernation media for overwintering adults of the tobacco flea beetle in several environments in North Carolina it was found that far greater numbers of the beetles per unit of area were present in old undisturbed tobacco fields than in fields in grass or the narrow strips along the edge of woods adjoining tobacco fields. In the tobacco fields the greatest numbers of flea beetles were found in the immediate vicinity of the old tobacco stalks.

TOBACCO HORNWORMS

During the latter part of the season in the North Carolina and South Carolina tobacco-growing areas hornworms became particularly abundant, and tests in the laboratory and in the fields where the tobacco had been primed showed that cryolite, either as a spray or as a dust containing 80 percent of cryolite (sodium fluoaluminate), was very effective against all stages of the hornworms. Cryolite mixtures containing less than 80 percent of cryolite were not effective, and the degree of toxicity decreased with the amount of cryolite contained in the dust mixture.

TOBACCO WEBWORM

Experiments performed in the dark fire-cured tobacco section of Tennessee showed that dipping the roots and root stalks of tobacco plants, prior to transplanting, in a liquid mixture containing a sufficient quantity of 85 percent cryolite to provide 1.9 percent of sodium fluoaluminate combined with a sticker was effective in reducing to a great extent the injury from the tobacco webworm (*Crambus caliginosellus* Clem.). Fish oil and mineral oil, each at the rate of 1.6 percent, animal glue at the rate of 0.37 percent, and billposter's paste at the rate of 0.75 percent were equally effective as sticking agents. The evidence from these experiments accumulated thus far indicates that dipping the roots of the tobacco plants constitutes a more effective control of the tobacco webworm than the corn meal-paris green-oil of mirbane bait which has been used heretofore in combating these pests.

CIGARETTE BEETLE

In experiments in Virginia designed to obtain information on an insecticide that might be used to combat adults of the cigarette beetle in tobacco warehouses of the open type it was found that pyrethrum dust mixtures containing a high percentage of pyrethrins were slightly more effective than the dust mixtures containing rotenone, but in no instance did the pyrethrum compounds give a percentage of kill that would be satisfactory in practical operations against the cigarette beetle adults in tobacco warehouses.

According to data obtained during the course of fumigation experiments against the cigarette beetle in Virginia it appears that a wide margin of error may occur in evaluating the efficiency of fumigants, particularly hydrocyanic acid gas, when used at relatively low temperatures in partial vacuum against the cigarette beetle infesting tobacco bales. In the instance of well-grown larvae of the cigarette beetle in which 3.9 ounces of liquid hydrocyanic acid was used per 1,000 pounds of tobacco a mortality ranging from 51.2 to 83.2 percent was attained at the expiration of the exposure period of 4 hours in partial vacuum. In test lots of cigarette beetle larvae thus fumigated and allowed to remain in the tobacco bales for 24 hours the percentage of mortality ranged from 67.2 to 82.4, for 48 hours it ranged from 91.2 to 96.8, and at the expiration of 67 hours it ranged from 90.4 to 100. To determine further the residual properties of hydrocyanic acid gas left in tobacco bales after fumigation in partial vacuum, test spikes containing cigarette beetle larvae were placed in bales of tobacco that had been removed from the fumigation tank after the customary aspiration of the tobacco bales had been applied. Examination of the test insects after 24 hours showed that the percentage of mortality ranged from 39 2 to 60, at the end of 48 hours from 39 6 to 67.2, and at the end of 67 hours from 56.0 to 87.2.

GREENHOUSE AND BULB INSECTS

Studies of greenhouse insects and pests affecting bulbs were continued at Sumner, Wash., Babylon, Long Island, N. Y., and Beltsville, Md. In the course of experiments directed against the gladiolus thrips in 1936 it was found that a combination spray consisting of tartar emetic and brown sugar gave a degree of thrips control equal to that obtained with the paris green-brown sugar spray and was not injurious to the gladiolus foliage. Moreover, it was shown that the tartar emetic-brown sugar spray did not have a deleterious effect on new corm production and that this mixture can be prepared at less cost than the paris green-brown sugar spray used formerly. The quantity of brown sugar used in this spray with the tartar emetic can be reduced approximately one-fourth over that used commonly with arsenicals without affecting the degree of control. Apparently sprays for the gladiolus thrips must be sweetened, however, since the substitution of a spreader and sticker for brown sugar in the spray mixture resulted in poor control of the gladiolus thrips when either tartar emetic or paris green was used as the principal ingedient.

In experiments performed on greenhouse-grown tomato and cucumber plants in which four sprays were applied at 4-day intervals against the common red spider and several species of thrips, principally the onion thrips, it was found that a derris spray having a rotenone content of 0.0056 percent was as effective as one with a rotenone content of 0.0112 percent; that the derris sprays used were superior to cube sprays of the same rotenone content; that the addition of pyrethrum extract aided in killing the thrips but did not improve the effectiveness of the sprays against the red spider; that with sprays of the same rotenone content containing sulphonated castor oil as a spreader the result was a better kill than when either alkylphenylbenzenesulphonic acid or rosin residue was used; and that a proprietary insecticide containing an aliphatic thiocyanate was as effective against the red spider as the derris spray plus sulphonated castor oil and did not harm the tomato plants, while a proprietary insecticide containing lauryl thiocyanate burned the plants severely after only two spray applications. In a second series of experiments, in which the same insecticides were used as in the first series but in which they were applied four times at weekly intervals, approximately the same results were obtained except that on the tomato the sprays containing derris, pyrethrum, and alkylphenylbenzenesulphonic acid appeared to be as effective as the sulphonated castor-oil sprays. The spray containing lauryl thiocyanate caused severe injury to both foliage and fruit of the tomato. None of the other sprays caused any permanent injury to either tomato or cucumber plants. On the whole a beneficial effect from the use of these sprays was clearly demonstrated, since on the sprayed plants the foliage remained greener and the plants continued to bear fruit much longer than on the comparable plants in untreated plots.

In cooperation with the New Jersey Agricultural Experiment Station, tests were conducted on the effect of high-frequency waves on the bulb nematode (*Ditylenchus dipsaci* (Kuhn) Filipjev). Negative results were obtained in these tests since no mortality to the bulb nematode resulted after exposures of 30 minutes in which waves of 12.5 and 42 meters, respectively, were used. The fumigation of narcissus bulbs with methyl bromide directed against the bulb nematode caused severe injury to the treated bulbs.

A survey of the bulb fields at Babylon, N. Y., to determine the percentage of infestation by the greater bulb fly showed the adults of the fly to be present in all fields examined, and from examination of bulbs in storage it was found that the percentage of infestation ranged from 0 to 54.5. Studies on the greater bulb fly were also conducted at Sumner, Wash., emphasis being placed on the control of the fly in the field. None of these tests yielded satisfactory control measures.

Japanese iris plants infested by the iris thrips which were held under conditions simulating transit for periods ranging from 7 to 10 days following treatment in hot water for 30 minutes at 110° F. to control the thrips grew as satisfactorily as those planted immediately after treatment. In the course of this experiment half the divisions of iris were planted immediately after treatment, whereas the others were packed in the same manner as for shipment, held for periods ranging from 7 to 10 days, and then planted. The foliage on the plants which were not set out immediately yellowed slightly and the new growth varied considerably in volume but the foliage developed satisfactorily during the year and was approximately equal to that of the iris planted immediately after treatment.

Tests in Virginia to determine the practicability of the hot-water treatment to control the cyclamen mite on cyclamen under commercial conditions disclosed that the treated plants showed no evidence of injury, and compared with untreated plants reserved as checks they showed considerable improvement in growth and flower-bud development, indicating that the method of immersing plants infested by the cyclamen mite in hot water maintained at a temperature of 110° F. for a period of 15 minutes has a direct commercial application.

Satisfactory control of the greenhouse mealybug (*Pseudococcus citri* (Risso)) on Saintpaulia plants was obtained by dipping them in several different solutions containing organic thiocyanates.

MUSHROOM INSECTS AND MITES

Tests made against various species of mushroom flies (*Sciara* spp.), mites, and other pests in the mushroom houses at Beltsville, Md., with a number of drenches, including free nicotine (40 percent), nicotine sulphate (40 percent), alcoholic extract of pyrethrum (2 percent total pyrethrins), hellebore powder, and derris-root powder demonstrated that the drenches containing free nicotine or the alcoholic extract of pyrethrum gave the best results, as judged by yield. The mushrooms treated with nicotine drenches were found to contain from 0.009 to 0.222 grain of nicotine per pound. The mushrooms having the higher content of nicotine were picked while still wet, immediately after the beds had been drenched. The higher content of nicotine is the equivalent of approximately 32 parts per million. In 8 to 10 days after treatment analyses of the mushrooms revealed no nicotine present or only traces. In tests to determine the effect of hellebore and borax drenches as used for the control of house fly maggots it was found that the hellebore had no perceptible effect on subsequent growth of the mushrooms but that the borax drenches prevented mushroom growth. Small-scale tests in the laboratory in fumigating with methyl bromide disclosed that it was necessary to use a dose of 3 pounds of this material per 1,000 cubic feet to obtain a mortality of the species of mite commonly found infesting mushrooms, and that this dose appeared to cause considerable harm to the mushrooms and to the spawn.

SWEETPOTATO WEEVIL CONTROL AND ERADICATION

The project on sweetpotato weevil control was started at the beginning of the year. Operations were begun in Alabama, Georgia, Louisiana, Mississippi, and Texas in cooperation with these States. The control program was designed to eradicate the pest from areas of commercial production where wild host plants do not grow perpetually, to prevent spread to uninfested areas, and to protect eradication work already done.

Extensive surveys were conducted along the fringe of the known infested area to delimit the northern boundary so that control operations could start from the periphery and work gradually into the more heavily infested areas in which eradication will be more difficult because of climatic factors and wild host plants. In the States above mentioned 172 counties were surveyed, revealing 2,555 infested properties in 33 counties. Inspections of seedbeds, fields, storage, sweetpotato plants, and wild host plants were included in the survey.

Eradication activities included the destruction of infested seedbeds, clean-up of infested fields and storage, destruction of volunteer sweetpotato plants on infested properties and those adjacent, and the destruction of such wild host plants as *Ipomoea littoralis* and *I. pescaprae*.

COTTON INSECT INVESTIGATIONS

In March 1938 investigations of the pink bollworm and other cotton insects at Mayaguez, P. R., were discontinued. The results of investigations of the damage and status of the pink bollworm, its host plants, and its control in Puerto Rico and studies relating to other cotton insects and the West Indian blister mite have been published by the Puerto Rico Agricultural Experiment Station of this Department and in the Journal of the Department of Agriculture of Puerto Rico. The station at Brownsville, Tex., where cotton insects have been investigated during the winter months for several years was discontinued in March 1938. The investigations of boll weevil control on sea-island cotton conducted in cooperation with the State entomologist of Georgia in McIntosh County last year were transferred during the spring of 1938 to Chatham County with seasonal headquarters at Savannah. The seasonal laboratory started in Florida in the spring of 1937 for investigations of boll weevil

control on sea-island cotton in cooperation with the Florida Agricultural Experiment Station was changed to a full-time laboratory in the spring of 1938. The seasonal laboratory for conducting studies of sucking bugs attacking cotton, started at Mesa, Ariz., in the spring of 1937, was changed to a full-time sub-laboratory of the Tucson, Ariz., laboratory in the spring of 1938.

BOLL WEEVIL

The low ebb of damage reached by the boll weevil in 1936 continued during 1937 in all the States except Virginia, North Carolina, South Carolina, and Georgia, where the damage approached average. The low initial population combined with hot and dry weather during the critical period over a great part of the central Cotton Belt prevented the infestation from building up to injurious numbers until late in the season. At Tallulah, La., the rainfall during June, July, and August 1937 was only approximately half of normal and the lowest for any recent years except 1924 and 1930. Although the weevil population was low during the summer, rainy weather prevailed during the fall of 1937, and where the crop was not defoliated by leaf worms cotton continued to grow and weevils to multiply until late in the season.

The survival in hibernation cages during the winter of 1937–38 varied in different localities. At Florence, S. C., and Tallulah, La., the 1938 survival was only about one-tenth as great as in 1937. At Tifton, Ga., the survival was higher and at College Station, Tex., about equal to that of 1937. Emergence from hibernation also continued late into the season of 1938. At Florence emerged weevils continued to migrate to trap plots of cotton until July 6, and 34 percent of the total weevils were taken after June 15 or after squares were present.

In the experiments on boll weevil control conducted at Tallulah during 1937 smaller gains were made than for any year since 1924 because of the light infestation. In plots dusted with the standard calcium arsenate treatment the average increase in yield was only 78 pounds of seed cotton per acre, or 3.3 percent, as compared with an average for the 17-year period 1920–36 of 330 pounds, or 26.4 percent. Considerable attention was given in 1937 to mixtures of calcium arsenate with other materials that would control the boll weevil with smaller quantities of arsenic and at the same time control the cotton flea hopper, other sucking insects, and leaf worms. At Florence, the mixtures of calcium arsenate and lime (1 to 1 and 1 to 2) that have given good control in recent years of low weevil infestation were not quite so effective as straight calcium arsenate dust. Mixtures of calcium arsenate and sulphur in several proportions were tested at Florence, Tallulah, Tifton, College Station, and at Port Lavaca, Tex., against the boll weevil. The results secured were in general as good as with calcium arsenate dust, and at College Station and Port Lavaca the results were better than with calcium arsenate. Cryolite and barium fluosilicate used as dusts in field-plot tests showed little promise for boll weevil control. In experiments designed to compare the efficacy of several materials that might be used as sweetened poisons when mopping for boll weevil control, cane syrup and white corn syrup were slightly better than blackstrap molasses, the material commonly used, and superior to agar agar, glycerine, and water; casein, glycerin, and water; or blood albumen, ammonia, and water.

The increased plantings of sea-island cotton in Georgia and Florida have focused attention on the need of methods of controlling the boll weevil on this crop. Boll weevil control on long-staple cotton is difficult because it is later in fruiting than short-staple cotton, continues growth and fruits over a longer period, and has bolls that are softer and remain susceptible to weevil damage for a longer time. Tests in 1937 indicated that frequent dusting with calcium arsenate will control the weevil on sea-island cotton and also clearly indicated that mopping with sweetened poison does not give adequate control of these late weevils.

Small-sized plots consisting of one-twentieth to one-tenth of an acre, instead of the usual 1-acre plots, were used this year in the weevil-control experiments at several stations with fairly satisfactory results. Cage studies of the toxicity of calcium arsenates having different chemical and physical properties were continued. The highest weevil mortalities were obtained with calcium arsenate having the following properties: Coarse as to particle size, of low density, high water-soluble arsenic by the New York method, and low molar ratio CaO/As_2O_5. No significant relation was found between mortality and (1) angle of slope, (2) loose bulking value at constant weight or constant volume, (3) total As_2O_5, (4) water-soluble As_2O_5 by the method of the Association of Official Agricultural Chemists, and (5) free $Ca(OH)_2$.

SOIL INJURY FROM CALCIUM ARSENATE

The studies on the injurious effects to crops following the use of calcium arsenate, previously reported, were continued. The production of cotton on the plot at Tallulah, La., which received 400 pounds of calcium arsenate per acre per year from 1931 to 1935, or a total of 2,000 pounds, was practically the same as on the untreated plot. Austrian peas and hairy vetch, planted as winter cover crops in 1937, were severely stunted and produced only 46 and 69 percent, respectively, as much on the treated as on the untreated plot. Oats yielded 23 percent more weight on the calcium arsenate-treated plot. On the plots representative of seven major soil types of Mississippi the calcium arsenate has not materially affected the yield of cotton or corn, but the yields of hairy vetch, Austrian peas, soybeans, and oats continue to be seriously reduced on plots which received from 800 to 1,600 pounds of calcium arsenate per acre. Analyses of the arsenic in the soil and crops are made annually to determine the rate of reduction of the arsenic in the soil and the amounts absorbed by the crops.

COTTON FLEA HOPPER

Additional information was secured at Port Lavaca, Tex., on the proportions of sulphur and arsenicals for the best control of the cotton flea hopper and other insects. The greatest increases in yield were secured in 1937 from dusting with a mixture of 1 part calcium arsenate and 2 parts sulphur. The average gain from the 1-to-2 mixture of calcium arsenate and sulphur was 277 pounds of seed cotton per acre and from sulphur dust 230 pounds per acre. The profit from dusting with the mixture of calcium arsenate and sulphur was $9.98 per acre, and from sulphur alone it was $8.39 per acre. The results obtained in flea hopper-control experiments during the past several years were published in a circular.

The most important parasite of the cotton flea hopper has now been described as *Erythmelus psallidis* Gahan. Confirmation was secured during the year that this species overwinters in the eggs of the flea hopper. The overwintering state of another egg parasite (*Anaphes anomocerus* Gir.) has not been definitely established, but it apparently does not overwinter in the egg of its host. The importance of these parasites is shown by the fact that in 30,610 flea hopper eggs collected in 1937 from several hosts, 31.9 percent were parasitized, 18.7 percent by *E. psallidis* and 13.2 percent by *A. anomocerus*.

HEMIPTEROUS INSECTS

Additional experiments on the control of hemipterous insects attacking cotton in Arizona confirmed previous results that substantial increases in yield can be secured by the use of insecticides. Dusting with calcium arsenate, lead arsenate, and sulphur have all given large increases in yield against these sucking insects, but mixtures of arsenicals and sulphur have given the largest gains. In tests conducted at Yuma in 1937, plots dusted with sulphur gave an increased yield of 1,274 pounds of seed cotton per acre, or 55 percent more than the check; a mixture of calcium arsenate and sulphur (1 to 2) gave an increase of 2,333 pounds, or 100 percent; while a mixture of 10 percent of paris green and 90 percent of sulphur (1 to 9) gave an increase of 2,691 pounds, or 117 percent. In experiments at Mesa, where the infestation was very light, and at Buckeye, where the infestation was much less severe than at Yuma, the gains varied with the intensity of the infestation. Lint from the treated plots was much less stained and was increased in value several dollars a bale. As a result of this year's work, a tentative dusting schedule of five to nine applications of 15 to 18 pounds of either of the foregoing mixtures, applied at weekly intervals, has been recommended to the growers. Population counts and studies of host-plant relationships have shown that cotton is not the favorite host plant of this group of insects and that other plants such as alfalfa, sugar beets grown for seed, sorghum, and desert vegetation, are the principal sources of the populations on cotton.

PINK BOLLWORM

Breeding and colonization were continued with the three introduced pink bollworm parasites (*Microbracon kirkpatricki* Wilk., *Chelonus blackburni* Cameron, and the Hawaiian strain of *M. mellitor* (Say)). Liberations of the three species were made in Texas and Mexico and of *C. blackburni* in Puerto Rico. Although recoveries have been made near the points of liberation it is

still not definitely known if any of the species have become established. *M. kirkpatricki* has been found not to hibernate and it requires the presence of host larvae for continuous breeding during the winter. Conditions in the fields of the Big Bend section are not favorable for the survival of this species, and breeding was discontinued in the spring of 1938 after the liberation of approximately 75,000 adults. Part of these liberations were made in the boll weevil-infested area of southeastern Texas, since it has been determined that this parasite also attacks the boll weevil under laboratory conditions. *C. blackburni* overwinters in the long-cycle pink bollworms and emerges about the same time as the pink bollworm moths. A shipment of *M. nigrorufum* Cushman, a parasite of the pink bollworm, was received from Japan in April 1938, through cooperation with the Division of Foreign Parasite Introduction of the Bureau. The technique of breeding has been developed and mass production is under way.

In the studies of varieties of cotton best suited for growing under pink bollworm conditions the quick-maturing eastern varieties again gave greater yields and better grades of staple than the slow-maturing varieties. The varieties with small open-type plants and determinate growth which mature a large proportion of their crop early in the season were less damaged by the pink bollworm than the other varieties. A date-of-planting experiment showed that a wide spread in the time of planting, especially in fields in the same vicinity, results in severe pink bollworm damage to late-planted cotton.

Results of studies on the relation of different winter treatments to pink bollworm survival showed that heavy winter pasturing of cotton fields decreased the pink bollworm carryover. Early winter burial of infested bolls followed by a winter irrigation decreased the survival much more than winter burial without a winter irrigation. Where no winter irrigations were applied early winter burial gave a higher survival than late winter burial. Survival was also greatly influenced by depth of burial, the survival decreasing with the depth.

Continued tests with insecticides failed to disclose a method that will give satisfactory control.

COTTON LEAF WORM

In 1937 the cotton leaf worm was first reported in southern Texas on June 5, about 2 weeks later than in 1936. Spread to the north and east from this area was comparatively slow. Infestations were found in northern Florida and southern Alabama a month before they appeared in Louisiana or Mississippi and were apparently due to a separate migration of moths from the Tropics. Observations in Puerto Rico during 1936 and 1937 showed that this pest bred continuously on cotton but at no time became abundant. This insect does not overwinter in the United States and the origin of these annual migrations of moths is still unknown. The mixtures of arsenicals and sulphur used for flea hopper and boll weevil control also controlled the leaf worms.

Commercial calcium arsenates, grouped according to high, intermediate, and low mortalities to boll weevils, were tested for toxicity against fifth-instar leaf worms. The groups causing high and intermediate boll weevil mortalities each averaged 93 percent leaf worm mortality and the low group only 76 percent. The median lethol doses of six calcium arsenates, lead arsenate, paris green, and two mixtures of paris green and calcium arsenate were determined for fifth-instar leaf worms by a modification of the sandwich method. The median lethal doses for the calcium arsenates ranged from 0.12 to 0.72 milligram per gram of body weight; for a mixture of 7.5 percent of paris green and 92.5 percent of calcium arsenate, 0.09 milligram; for a mixture of 10 percent of paris green and 90 percent of calcium arsenate, 0.04; for lead arsenate, 0.02; and for paris green, 0.01.

BOLLWORM

Most of the damage by the bollworm in eastern Texas during 1937 was caused by the second generation of bollworms on cotton and consequently occurred late in the season. Better gains were again secured in the 1-acre plots by dusting with calcium arsenate than with the following other insecticides tested: Mixtures of calcium arsenate and sulphur (1 to 1 and 1 to 2); mixtures of sulphur and paris green (7.5 and 10 percent, respectively); barium fluosilicate; and sulphur with 20 percent of cryolite. Barium fluosilicate gave good control and increase in yield in a limited number of tests but the results from a cryolite-sulphur mixture were disappointingly low. In tests with plots of one thirty-second of an acre arranged in a Latin square the yields

indicated that calcium arsenate, calcium arsenate plus paris green (5 and 10 percent, respectively), and calcium arsenate plus 50 percent of sulphur were equally effective against the bollworm when the mixtures were applied at the rate of 7.76 to 9 pounds of calcium arsenate per acre. When the rate of application of calcium arsenate was reduced to 7 pounds per acre in a calcium arsenate-lime mixture the yield was likewise reduced. Pyrethrum and sulphur (0.09 percent pyrethrins I and II) was not effective against this insect.

THURBERIA WEEVIL

Studies on the changes in biology and habits of the Thurberia weevil when removed from its native host, *Thurberia*, and bred exclusively on cotton were concluded and the weevil eradicated from the field used for this purpose. Records of emergence of weevils from *Thurberia* plants growing under natural conditions in the mountains show a definite correlation with the occurrence of rains during July and August and further corroborate previous evidence that the infestations in cultivated cotton in the Santa Cruz Valley are due to a transfer from the *Thurberia* plants and not from a carry-over in the fields.

ROOT APHIDS

Investigations were continued on the aphids *Anuraphis maidiradicis* (Forbes), *Trifidaphis phascoli* (Pass.), and *Rhopalosiphum subterraneum* Mason attacking cotton. The three species are generally distributed throughout the cotton-producing sections of the Carolinas and Virginia and cause appreciable loss to cotton in these States. Control is difficult because of the large number of weed and cultivated host plants, the subterranean habits of the aphids, and the fact that they are attended by ants that move the stem mothers from place to place and start new infestations.

VARIETAL RESISTANCE OF COTTON TO INSECTS

An investigation of the varietal characters of cotton in relation to attack by the boll weevil, aphids, and thrips is being conducted at Stoneville, Miss., to secure basic information for use by plant breeders in developing varieties that are more tolerant or immune to insects. Excellent material is available at the Delta Branch Station of the Mississippi Agricultural Experiment Station in the collection of all the principal species and varieties of cotton grown for genetical studies and varietal tests. Of the 44 varieties of cotton studied, the varieties producing bolls of medium thickness were less damaged by the weevil than those with either thick or thin boll walls. A negative correlation was found between boll-wall thickness and toughness of the carpel lining as measured by a resistometer. No varieties or individual plants have been found that are resistant to aphid attack, although the increase in population on varieties with different degrees of pilosity was in direct proportion to the number of hairs on the lower leaf surfaces. Dusting with calcium arsenate increased the aphid population on all types of cotton, but the ratio of increase was greater on the glabrous varieties. Preliminary studies indicate that some varieties are more seriously damaged by thrips than others, but the factors responsible for these variations have not been determined.

PINK BOLLWORM CONTROL

The discovery of reinfestation by the pink bollworm in the Santa Cruz Valley of Arizona and also in Pinal County, Ariz., after a lapse of several years, and a rather general spread of infestation in the regulated areas, with an increase in the degree of infestation in the Pecos Valley in both Texas and New Mexico, were among the more important developments of the 1937 crop season. The infestations in the two Arizona areas are light, and they were brought under regulation on January 3, 1938.

REINFESTATION IN ARIZONA

Cotton plantings in the Santa Cruz Valley extend from near Nogales, in Santa Cruz County, northward to about 18 miles above Tucson, in Pima County. Most of the acreage is in the upper part of the valley, in the Marana section. The last previous infestation was found in the 1930 crop. The first specimens in the 1937 crop were found on November 2, additional specimens being taken

almost daily until November 17, when work was discontinued. By securing individual samples of trash at gins it was determined that infestation was general from the southern part of the valley northward to Rillito, but the results were negative for the Marana section.

Following discovery of the infestation, intensive inspections were begun in Pinal County. This county had previously been infested, the last infestation having been in the 1931 crop and the county having been released from regulations in December 1933. Conditions were ideal for inspections, and the fact that only one specimen was found indicates that the new infestation is extremely light.

In view of the discovery of a rather general pink bollworm infestation in southern Arizona, the question arose as to whether or not this insect was infesting *Thurberia* plants. To obtain information on this point several thousand *Thurberia* bolls were collected in November and December from various mountain ranges. The inspection of these resulted in the discovery of one specimen from bolls collected in the Rincon Mountains east of Tucson. Following this finding additional bolls were collected, but no further specimens were found. Over 88,000 *Thurberia* bolls were inspected.

SITUATION IN OLDER REGULATED AREAS

Weather conditions were unusually good throughout the season, and as a result very thorough gin-trash inspections could be made. In the lower Rio Grande Valley of Texas infestation was again established. To check on any possible build-up of infestation the work in Cameron County was divided into two periods. From July 7–31, 422 bushels of trash were inspected and 10 pink bollworms found. On August 20 and 21, 12 pink bollworms were taken from 73 bushels of trash, which indicates some increase. In addition, one specimen was taken in Hidalgo County, but results were negative in Willacy and Starr Counties. In the Texas Panhandle infestation was found in 6 counties, 29 specimens being found. This is a slight increase over the previous season. In the Pecos Valley of Texas there was a considerable increase in the number of specimens found; in fact, the records show this to be the heaviest infestation that has ever been found in that section. The same situation exists in the southern part of the Pecos Valley of New Mexico, but only one specimen was found in the northern part. In the El Paso, Mesilla, and Safford Valleys there was very little change. In the Deming area a general but light infestation was found throughout the cotton acreage.

A summary of the amount and results of the various types of inspection is given in table 9.

TABLE 9.—*Summary of inspections for the pink bollworm in regulated areas, crop season of 1937*

District	Gin trash		Field		Laboratory	
	Bushels	Pink bollworms	Man-days	Pink bollworms	Green boll samples	Pink bollworms
Lower Rio Grande Valley, Tex.	5,141	23	0	0	0	0
Texas Panhandle	6,001	29	0	0	73	0
Pecos Valley, N. Mex.	120½	181	(1)	14	81	12
Pecos Valley, Tex.	7½	623	0	0	68	7
Big Bend, Tex.	0	0	(1)	25	0	0
Hudspeth County, Tex. (southeastern part) [1]	10	1,367	0	0	20	1,252
El Paso Valley, Tex.[1]	3	31	0	0	127	83
Mesilla Valley, N. Mex.[1]	65¼	6	0	0	82	1
Tularosa, N. Mex.	0	0	0	0	0	0
Deming, N. Mex.[1]	7¼	143	0	0	24	100
Duncan Valley, Ariz., and N. Mex.	(2)		0	0	12	0
Safford Valley, Ariz.	580	26	0	0	25	0
Tucson, Ariz.[3]	1,473	52	(1)	7	0	0
Casa Grande, Ariz.[4]	4,550	1	0	0	0	0
Total	17,958½	2,482	(1)	46	512	1,455

[1] Incidental inspections.
[2] All cotton ginned in Safford Valley and inspections included under that district.
[3] 35 specimens of the Thurberia weevil were found.
[4] Some of the inspections made before area was placed under regulations.

CONTROL IN THE LOWER RIO GRANDE VALLEY

Mention was made in the last annual report that regulations enforced in the lower Rio Grande Valley would be somewhat modified. Instead of requiring each gin to install a sterilizer, large plants have been erected at various points in the district and all seed for milling purposes is heated to 155° F., after which it is allowed movement to any destination. Seed for planting purposes is stored in approved places until the end of the ginning season and is then sterilized by the State of Texas. A simple permit system is used, so the amount of unsterilized seed remaining in the district and the persons who have the seed are known at all times.

Owing to the mild climate, cotton plants are seldom killed by frost, and under usual conditions produce plenty of fruit to maintain the pink bollworm throughout the year. Therefore regulations were issued by the State of Texas providing that cotton stalks are to be destroyed after the harvesting season and not later than October 1. This would eliminate, during a period of some 6 or 7 months, any material on which the insect could propagate. Some 295,000 acres were planted to cotton in the 1937 crop, and on the whole very good cooperation was received in connection with the stalk-destruction program. One of the biggest difficulties was the fact that a considerable acreage is owned by nonresidents, and in some cases it was impossible to locate them. Incidentally, a similar program was carried out on the Mexican side.

CONTROL PROGRAM IN THE BIG BEND AREA OF TEXAS

In the fall of 1932 a special control program was instituted in the Big Bend to reduce a very heavy pink bollworm infestation and eliminate as much as possible the danger of spread to other areas. In brief, this program consisted of thorough clean-up of fields in the fall; delayed planting of the cotton crop the following spring, so that the peak of moth emergence would pass before cotton began fruiting; and the use of small plots of cotton to trap the later emerging moths. As mentioned in the last annual report, this program was abandoned for the 1937 season. A very heavy infestation developed in the 1937 crop, the damage being estimated by various farmers to be as high as 75 percent in some few cases, with the average being perhaps from 30 to 40 percent. Farmers requested that the program be resumed. This heavy infestation presents a grave menace to other cotton areas; therefore, early in 1938 the Texas Pink Bollworm Commission held a hearing at Marfa to consider what steps should be taken. As a result a 2-year plan of control was submitted and has been agreed to by the Federal and State departments, and farmers in the area have promised complete cooperation. Briefly, the plan is that all cotton in the fall of 1938 be picked and ginned as promptly as possible; that prior to October 1 all cotton stalks be cut and piled while still green, the stalks to be piled the same day they are cut and the piles burned as soon as the stalks are sufficiently dry; all storage places for cotton or cotton products to be thoroughly cleaned; and in the spring of 1939 no cotton to be planted prior to May 1.

INSPECTION OUTSIDE REGULATED AREAS

Conditions as a rule were especially favorable for inspection outside regulated areas. The territory covered during the 1937 inspection season was not so large as during the previous year, but about half again as much trash was inspected. Intensive inspections were made in northern Florida, southern Georgia, southern Alabama, southern and northwestern Texas, southwestern Oklahoma, and Maricopa and Pinal Counties, Ariz. The border cotton-growing areas of Mexico adjacent to the lower Rio Grande Valley of Texas were also inspected very thoroughly. The only findings other than the specimen at Casa Grande, Ariz., were in Mexico. In the Matamoros area, which is opposite the lower Rio Grande Valley of Texas, considerable inspection was done. Specimens of the pink bollworm were found on the first day and almost daily thereafter. Inspections began on July 20 and were continued through July 28, 338 specimens being found in the 287 bushels of trash examined. In the Don Martin project, an important cotton section, results were negative. In the Juarez Valley, which is opposite the El Paso Valley of Texas, some incidental inspections of trash were made by hand and specimens readily found. A summary of the amount and results of the various kinds of inspection is given in table 10.

TABLE 10.—*Summary of inspections for the pink bollworm outside regulated areas, crop season of 1937*

State	Gin trash		Field		Laboratory	
	Bushels	Pink bollworms	Man-days	Pink bollworms	Samples	Pink bollworms
Alabama	3,411	0	0	0	0	0
Arizona	12,508	0	0	0	0	0
Florida	1,878	0	(1)	1	595	0
Georgia	7,954	0	0	0	582	0
New Mexico	0	0	0	0	99	0
Oklahoma	5,873	0	9	0	141	0
South Carolina	740	0	0	0	0	0
Texas	53,811	0	0	0	1,322	0
Total	86,175	0	9	1	2,739	0
Mexico:						
Chihuahua [2]	4	48	0	0	0	0
Nuevo Leon	1,631	0	0	0	0	0
Tamaulipas	732	665	(2)	32	0	0
Total	2,367	713	0	32	0	0
Grand total	88,542	713	9	33	2,739	0

[1] Incidental inspection of experimental plots of cotton on the city of Miami farm. All the cotton was destroyed immediately after this specimen was found.
[2] Incidental inspections.

WILD COTTON ERADICATION

The eradication of wild cotton in southern Florida was continued. This work was begun in 1932 to eliminate a rather heavy pink bollworm infestation and thus remove the danger of spread to the main Cotton Belt. Owing to climatic conditions effective work can only be done during the fall and winter and early in the spring. The past season was unusually favorable for eradication work. A deficiency in rainfall made working conditions more agreeable, helped to keep down insects, retarded the growth of wild cotton plants and other vegetation, and made it possible to reach some locations which are ordinarily rather difficult. The upper west-coast counties were cleaned 3 times, and only 81 plants containing mature fruit were found. The Ten Thousand Islands section, which is perhaps the most difficult to work in the entire district, was cleaned twice. As a result of a survey made with an autogiro during the spring of 1937, 14 new colonies of wild cotton, covering 59 acres, were located and cleaned. One of these colonies in Collier County was infested with the pink bollworm. The Cape Sable and Florida Bay sections were cleaned twice, the mainland keys were also cleaned twice, and some of the colonies were cleaned three times. In the Florida Bay section two new colonies were located and cleaned. This makes 16 colonies which were located and cleaned for the first time. They covered approximately 71 acres and contained 1,129 mature and 1,218 seedling plants. During the recleaning 1,127,183 seedling and 3,511 sprout plants were removed. In addition, over 15,000 acres were scouted without any wild cotton being found. In view of the surveys that have been made it is believed that all wild cotton has now been located and cleaned. The work hereafter will consist in cleaning the various colonies before any of the plants can mature and shed seed. This procedure has been followed for several seasons in the counties nearest cultivated cotton, and there has been a very noticeable decrease in the number of seedling plants that come up each season.

THURBERIA WEEVIL CONTROL

That part of southern Arizona infested with the Thurberia weevil has been under regulations for a number of years, and similar control measures are used for both the pink bollworm and the Thurberia weevil. The host of the weevil is *Thurberia thespesioides*, a plant which grows in various mountain ranges. Approximately 6,000 acres are planted to cotton, and each season a few weevils have been found. During the past season 35 weevils were found as a result of gin-trash inspection.

In 1935 emergency relief funds were used to attempt eradication of *Thurberia* plants in the nearby mountain ranges and thus remove the menace from cultivated cotton. This work has been carried on continuously since it was begun. The range nearest cultivated cotton was first cleaned, after which work was begun in the Santa Catalina Range, which is next nearest, and all work during the past season was in this range. Work was carried on from a camp in the mountains, and as various sections were completed the camp was moved from time to time. During the year 19,600 acres were covered and 106,034 *Thurberia* plants destroyed. The majority of these plants were infested with the Thurberia weevil. Since work was begun 200,150 acres have been covered and 1,320,042 *Thurberia* plants destroyed.

BEE CULTURE

In March 1938 a new field laboratory was opened at Madison, Wis., in cooperation with the Wisconsin Agricultural Experiment Station and the University of Wisconsin. Beekeepers, acting under the agency of the American Honey Producers' League, assisted in establishing this laboratory by donating hives and bees. Immediate work assigned to the new laboratory includes problems of supersedure and package bees in commercial honey-producing apiaries, especially under conditions encountered in the North Central States.

In the study of resistance to American foulbrood, colonies headed by line-bred queens of strains showing resistance made a better showing when inoculated with American foulbrood than did colonies headed by queens of any one of these strains mated with drones from the other strains. During the spring of 1938 some 2,500 queens of resistant stock were reared for distribution among beekeepers for testing under commercial apiary conditions.

In studies of the intestinal tracts of bees fed honey infected with spores of *Bacillus larvae*, the causative organisms of American foulbrood, such spores were recovered from the rectal ampullae of worker bees and then grown in culture. This indicates a possibility that the excreta of diseased bees may be a means of spreading the disease.

An easily prepared culture medium for *Bacillus larvae* was devised that possesses distinct advantages over media previously used in the Bureau. For example, growth of *B. larvae* was obtained with it when the number of spores present averaged only 1 per cc, whereas in the past the minimum number with which growth could be obtained in culture has been held to be 50,000 per cc. The way now seems open for making single-spore cultures for studies of pure strains.

Commercial high-test lye, in various concentrations ranging from 1 pound in 1 gallon of water to 1 pound in 30 gallons, proved to be a relatively weak disinfectant for spores of *Bacillus larvae* at both 37° and 70° C. Spores exposed to boiling in water appeared to become attenuated, and the use of larger inocula was necessary to obtain growth in culture than is the case with untreated spores.

A total of 1,041 samples were received for disease diagnosis and inspection. These included 789 samples of brood and 66 of the dead or abnormal adult bees, as well as 186 imported queens submitted for inspection of their attendants for the mite *Acarapis woodi* (Rennie), in accordance with existing regulations.

In the breeding work a satisfactory X-ray dosage for queens was determined and three mutations resulted, but none was held suitable for use as genetic markers. Attempts to mate bees within a copper-screen enclosure 20 by 20 by 20 feet were unsuccessful. The unmated queens and drones appeared to fly freely from, and to return to, hives within the enclosure, but the drones invariably flew against the cage walls repeatedly or rested on them while absent from their hive. No apparent attempt at mating was observed.

Studies of the cubital indices of various races so far have consistently given lower values for the Caucasian than for other races.

Cooperative work with the Oregon Agricultural Experiment Station showed wide variation in the quantity of nectar produced by different varieties of pear trees in the Rogue River Valley in Oregon. The Bosc, Anjou, and Comice, varieties that present a pollination problem, produced only meager quantities. The amount of nectar produced by pear trees was observed to increase with temperature, but the percentage of sugars in it remained low in comparison with that in nectar of other flora competing for the attention of the honeybee. Bees obtained considerable pollen from the blossoms early in the morning.

A chemical analysis of various pollens to determine their relative food values for the honeybee was undertaken in cooperation with the division of chemistry of the University of California. So far the protein and fat content has varied

widely in different pollens. The pollens collected for study vary in color throughout most of the range of the visible spectrum. Carotin was found associated with orange-colored pollens.

In a study of the effect on a colony of removing a portion of its bees, as occurs when a colony is used for package-bee production, the resulting population of test colonies from which 3 to 4 pounds of bees were removed every 10 days for a 3-month period this spring apparently was not materially reduced below that of colonies from which only 2 pounds of bees were removed, or even below that of check colonies from which no bees were removed.

Work in cooperation with the division of chemistry of the University of California showed that the treatment of beeswax with citric, oxalic, and phosphoric acids will remove metal stains and restore the yellow colors without seriously affecting the acid number. The acid can be removed by washing with hot water although when this is done the wax becomes slightly harder. Beeswax has been separated into six fractions at various temperatures from 0° to 70° C. These fractions ranged in hardness from that of vaseline to that of rosin. The coloring materials were contained in fractions removed at lower temperatures. Propolis, a common contaminator of beeswax, was shown to be a variable material having a higher acid number, iodine number, and density but a lower saponification number than beeswax.

Field surveys continue to emphasize the importance of the supersedure problem and the necessity of having hardy queens of good stock for use with package bees. Thus, of the queens in 143 packages established by the field laboratory at Madison, Wis., 2.8 percent were lost during introduction, 3.5 percent failed to lay, 3.5 percent were lost during the first week, 4.9 percent during the second and third weeks, 1.4 percent during the fourth and fifth weeks, and 4.2 percent during the sixth and seventh weeks, making a total of 20.3 percent. Of the queens still retained in the colonies at the end of the seventh week those classed as inferior amounted to 19.6 percent of the original number.

The work on supersedure resulted in the publication of a method for installing package bees which includes spraying both package bees and queens with sugar sirup, thereby permitting the direct release of the queen among the package bees and the commencement of egg laying with a minimum loss of time. In certain field studies the time required for initial egg laying by package queens was reduced from an average of 4.2 days to less than 1 day by use of this method.

In an effort to determine whether conditions surrounding the development of the queen play any part in supersedure, the physiological and chemical investigations on the growth and development of queens and workers were largely completed. The chemical studies included an analysis of the nitrogen, lipid, and carbohydrate content. Royal jelly was found to contain 20 units of vitamin B per gram, but vitamin A is absent. The biological value of the protein content is 75 percent. Royal jelly was also found to possess definite bacteriostatic and bactericidal properties. Since it has been ascertained that both worker and queen honeybees develop at approximately the same rate during the first 4½ days of larval life, after which the workers' development is retarded, it would appear that either a qualitative or a quantitative dietary deficiency is a contributing factor in causing the dimorphic condition.

The studies on vitamins A and B in royal jelly were carried on in cooperation with the Bureau of Chemistry and Soils while the germicidal studies were conducted in cooperation with the bacteriology department of Louisiana State University.

Studies on the lethal effect of insecticides on the honeybee showed that 2 micrograms of calcium arsenate or of arsenic pentoxide was sufficient to reduce the longevity of caged honeybees 50 percent as compared with the longevity of control bees. For lead arsenate the corresponding figure was 10 to 15 micrograms. Phenothiazine did not reduce the longevity to this extent, even when more than 500 micrograms per bee was fed. Phenothiazine was considerably repellent to bees, whereas lead arsenate and calcium arsenate were only slightly so.

INVESTIGATIONS OF INSECTS AFFECTING MAN AND ANIMALS

SCREWWORMS AND BLOWFLIES

To expedite the testing of materials as protectors against screwworm infestation of wounds in various classes of livestock and to give experimental conditions more directly comparable with those on ranches a 1,300-acre tract was leased near Menard, Tex. This land, which is typical of the ranches of that area, has been stocked with about 1,300 sheep and goats and a few other livestock for use in the experimental work.

Previous work had shown that phenothiazine is an excellent material for killing young screwworm larvae infesting a wound, and that this chemical would protect the wound against subsequent infestation for a considerable number of days. Since phenothiazine, however, is relatively nontoxic to screwworms over 3 days old, search has gone forward to discover a chemical having the protective properties of phenothiazine and yet toxic to all stages of screwworms. During the season 1937–38 approximately 550 different organic compounds were tested, of which 46 were shown to possess greater toxicity to screwworms than phenothiazine. Three of the latter were indicated to be of exceptional value for the prevention and treatment of screwworm cases in range livestock.

Two important developments in the investigation of methods for controlling horn flies give promise of providing means of greatly reducing screwworm cases predisposed by these flies. One of these, a unique discovery in insect-control methods, consists in feeding animals phenothiazine. Most of this chemical is unabsorbed by the animal and passes out with the undigested contents of the alimentary tract, and its presence in the manure prevents the development of horn fly larvae therein. This finding appears to have possibilities in meeting the problem of horn fly control in range areas where the disposal of manure to prevent fly breeding is not practical. The other method of horn fly control resulting from the year's work was the development of an automatically operated fly trap. One year's practical test with the device indicates that it will provide an inexpensive and efficient method of ridding dairies, feed lots, and fairly large ranches of the pest.

In cooperation with the Bureau of Animal Industry investigations were begun to find a treatment for screwworm-infested animals which would promote healing of the injuries and thus reduce the expense of feeding and treating wounded animals over a relatively long period.

Continued observations on the overwintering habits of the primary screwworm fly (*Cochliomyia americana* C. and P.) showed that in southwestern Texas the pest survived the winter of 1937–38 south of a line from Uvalde westward to the Rio Grande and up the valley of the Pecos River as far north as Sheffield; in the Southeast, from Valdosta, Ga., southward; and in Arizona throughout the southwestern part of the State.

Dispersion of the primary screwworm fly from the overwintering area, which apparently began in March, reached its northern limit, a line extending from Oklahoma City, Okla., to Amarillo, Tex., and Tucumcari, N. Mex., by July 18. Dispersion eastward reached western Louisiana about July 1 and north-central Louisiana about August 1. The rate of migration of the pest was somewhat slower in a northerly direction in 1937 than in 1936 but was more rapid toward the east. Migration was uniformly progressive until the first of August, when the hot, dry weather in the north and excessive rainfall in eastern Texas and Louisiana stopped further movement.

In certain sections of the Southwest several species of ants, especially those belonging to the genera *Eciton* and *Pheidole*, destroy from about 65 to 90 percent of the larvae and pupae of *Cochliomyia americana* that develop from the carcass of an animal that has died of a screwworm infestation. Histerid beetles are not known to destroy screwworm larvae but they devour large numbers of the larvae of other blowflies present in a carcass.

It is indicated that from 50 to 90 percent of the larvae and pupae of screwworm flies are destroyed by natural agencies.

Temperatures considerably affect the populations of various genera of blowflies. In a period having a mean monthly range below 50° F. species of *Calliphora* and *Cynomya* predominate, between 50° and 70° species of *Phormia* are the most abundant, and with temperatures above 70° species of *Cochliomyia* are most numerous.

Research on the factors which induce screwworm flies to oviposit on wounds of animals showed that there is a close correlation between the pH value of

the wound secretions and the degree of attractiveness of the wound for the flies. The greater the alkalinity within certain limits, the larger the number of eggs deposited.

FLY SPRAYS

Research in perfecting insecticidal sprays for the protection of livestock against biting flies resulted in the finding that careful selection of the base mineral oils within certain boiling-point ranges greatly increases the killing power of the spray. It was also discovered that the use of certain vegetable oils having no toxicity to insects in themselves materially enhances the lethal effect of pyrethrum and other insecticides when these are combined with the oils in an insecticidal mixture.

INSECT-BORNE DISEASES

With the devastating outbreak of equine encephalomyelitis in the North Central, Western, and Southwestern States during the summer of 1937 which resulted in the death of some 45,000 animals, the Bureaus of Animal Industry and Entomology and Plant Quarantine cooperated in an effort to determine the species of insects responsible for the transmission of the disease. Although certain species of culicine mosquitoes appeared to be the vectors in parts of the Southwest, the epizootic died out before conclusive data could be obtained.

An epidemiological survey of a disease of domestic turkeys in the Southeast showed a high incidence of the disease in that area, and that the disease is apparently responsible for a heavy mortality among young birds.

HOUSEHOLD AND STORED-PRODUCT INSECTS

In addition to a large amount of work of a public-service nature in supplying information to individuals and commercial concerns on methods of controlling household and stored-product insect pests, assistance was given the Army, Navy, and C. C. C. in fumigating barracks for the eradication of bedbugs and other vermin. Cooperation was extended the Procurement Division of the Treasury Department and other Government agencies for the protection from insect damage of commodities in storage.

A number of Government publications giving information on the control of insects in the household were prepared during the year.

Because of the increasing demand of manufacturers for a substance which will impart a moth-resistant quality to woolen fabrics, an intensive study was begun to determine which chemicals not under patent at the present time would be suitable for this purpose.

Neogastrallus librinocens Fisher, a new pest of books and papers, was discovered to be causing extensive damage in libraries in Florida. Although this pest has probably been present in the United States for a number of years, this is the first time that it has been recorded, and the first evidence of the seriousness of the damage it can cause in this country.

TICKS AFFECTING MAN

Because of the increased abundance of the American dog tick and the incidence of the eastern form of Rocky Mountain spotted fever which it carries in the East, a laboratory was established at Vineyard Haven, Mass., in July 1937 for investigating the control of this tick. The tick, besides being a vector of disease, is a serious pest of man and dogs in most of the States east of the Rocky Mountains. Sporadic cases of spotted fever have been reported from practically every State in which the tick occurs.

The problem of controlling the tick is complicated by the fact that its immature stages are parasitic on small wild rodents, whereas the adults attack larger animals, the dog being the principal host.

Various control methods are being tested as rapidly as possible. The principal lines of attacking the problem are (1) the poisoning of rodents to eliminate the hosts of the immature ticks, (2) controlled burning of brush and undercover vegetation to destroy dormant or inactive stages of the tick and to remove favorable haunts of rodents, (3) systematic treatment of dogs in an area to destroy the adult ticks, (4) the use of tickicides and repellents sprayed on vegetation for ridding relatively small areas of the pest, and (5) the use of insect parasites of the tick.

Experiments on control of the tick during the year gave encouraging results. It was found that spraying vegetation with nicotine sulphate (1 to 200) will effectively rid an area of ticks for approximately 3 days.

MOSQUITOES

Research on the biology, habits, and ecological relationships of mosquitoes showed, in the case of certain floodwater species in the Pacific Northwest, that there is a close relationship between temperature and percentage hatch of the eggs. In midwinter five alternate dryings and floodings of the eggs in the soil are required before they will all hatch, whereas in April, May, or June, after the eggs have passed their winter in dormancy, a single flooding will cause all of them to hatch. Eggs that would normally hatch on the first flooding during the period from June to August will become dormant again in September, after which more than one flooding is required to make them hatch. Observations also showed that the eggs may change from the winter dormant stage as early as April 20 in early seasons and as late as June 8 in late seasons. Therefore flood crests that occur before these dates do not cause the hatching of all viable eggs.

Additional data obtained during the past season demonstrated that eggs of the flood water mosquitoes *Aedes vexans* (Meig.) and *A. aldrichi* D. and K. may remain viable in the soil for at least 4 years under natural conditions.

The development of a machine for separating mosquito eggs from soil and a careful study of the differences in characteristics of the eggs of various species have greatly increased the rapidity with which studies on the biology of the more important forms can be completed.

Among the more important developments on methods of controlling mosquitoes during the year the following may be cited:

(1) The addition of 10 percent of pine oil to a pyrethrum-base oil mixture increased the mortality of mosquito larvae (*Culex quinquefasciatus* Say) from 7 to 65 percent and from 34 to 72 percent after the larvae had been exposed to the action of the larvicide for 1 and 24 hours, respectively. A pine-oil activator (10 percent) added to a pyrethrum-base oil mixture increased the mortality of mosquito larvae from 7 to 89 percent and from 34 to 96 percent after 1 and 24 hours' exposure, respectively.

(2) Waste crankcase oils are in general unsuitable as mosquito larvicides. Their toxicity can be increased by the addition of such materials as kerosene, 5 percent of crude cresylic acid, and 5 percent of a light coal-tar creosote oil containing 12 percent of tar acids and 34 percent of crude naphthalene, but even witih this increased killing capacity they are not any more effective than fresh fuel oil or Diesel oil and are more expensive.

(3) Cashew-nutshell oil is a promising new mosquito larvicide. Applications of this oil at the rate of 12.5 gallons per acre of water surface result in killing 85 to 95 percent of the larvae.

Cooperation wiith the Bureau of Biological Survey and the Civilian Conservation Corps relative to the mosquito-control work of C. C. C. camps in New Jersey, Delaware, and Maryland was continued. In addition to the technical advice given on methods of mosquito control on various types of salt marshes, observations were made on the effectiveness of ditching in the control of salt-marsh-breeding mosquitoes, the effect of the ditching on the flora and fauna of salt marshes, and the influence of this method of mosquito control on wildlife.

Changes in marsh fauna as a result of ditching are dependent on the extent of flooding to which the marsh is subject. Ditched marshes which have regular tidal floodings appear to have practically the same numbers of animals suitable for wildfowl food per unit of area as do unditched marshes. Because the effect of ditching on the physical and chemical characteristics of the soil and the water level is so varied in different marshes, and in different sections of an individual marsh, it is indicated that a thorough study of marsh conditions should be made before ditching is begun.

A compilation of data secured over a period of several years furnished material for a comprehensive manuscript, now in course of publication, on the taxonomy, biology, habits, and control of the mosquitoes in the southeastern part of the United States.

INSECT IDENTIFICATION

The total number of identifications made and reported was 66,006, of which approximately 36 percent were for the Division of Foreign Plant Quarantines and 38 percent for the remaining divisions of the Bureau and other Federal

units, while the balance were distributed among agencies of the various States and insular possessions, individuals of the United States, and foreign institutions and individuals. Approximately 1,200 lots remained unfinished at the end of the year. This is the smallest number of uncompleted lots on hand at any one time for several years and indicates definite improvement in expediting identifications, for which an increase in staff during the year is largely responsible. To facilitate and expedite the identification of material taken in connection with the white-fringed beetle survey in the Southern States a special identification project was established at Gulfport, Miss., late in the year. As usual, assistance in taxonomic problems has been rendered numerous outside investigators, and considerable attention has been given to the maintenance and improvement of the extensive insect collections that are essential for reference purposes in connection with identification work.

The time not required for service activities was devoted to research studies on various taxonomic and morphological problems in order to improve the classification in different insect groups and so to make possible more definite and complete determinations. Forty-seven manuscripts were completed, of which 30 were published. In addition, considerable work was performed on a number of extensive studies that were not completed. Included in this group are the following: Classification of the white grubs; revision of the bark beetles of the genus *Hylastes;* revision of the weevils belonging to the genus *Pantomorus;* revision of the wood-boring beetles of the genus *Chrysobothris;* classification of the American moths of the subfamily Phycitinae; revision of the moths of the family Oecophoridae; revision of the fruitflies of the genus *Anastrepha;* revision of the blowflies of North America; revision of the parasitic wasps of the genus *Ophion;* revision of the North American bees of the genus *Osmia;* generic classification of the leafhoppers of the family Cicadellidae; revision of the plant lice of the genus *Myzus;* synopsis of the scale insect genus *Cerococcus;* monograph of the scale insects of the genus *Asterolecanium;* catalog of the North American moths of the family Noctuidae; generic revision of the North American thrips; catalog of the Anoplura or sucking lice; study of the male genitalia in the Hymenoptera.

FOREIGN PARASITE INTRODUCTION

The foreign work of parasite introduction was centered, as heretofore, at the field stations at St. Cloud, France, and Yokohama, Japan. Activities in Europe on the pine shoot moth and larch casebearer have been completed, and a study of the spruce sawfly begun. In the oriental field extensive work on natural enemies of the pink bollworm was undertaken, while the emphasis in the oriental fruit moth work was changed from the collection and shipment of parasites to field studies.

A parasite-receiving station was established at Moorestown, N. J., for the quarantine handling of imported material. Shipments from the various foreign countries are received at this station and, if living host material or hyperparasites are included, the adults are reared and only pure colonies of the desired species forwarded to the field stations for liberation. Thirty-three shipments were received from foreign sources and 48 shipments, principally of reared material, transmitted to the Bureau's various field stations for colonization. In addition, eight consignments of parasite material were prepared and forwarded to foreign countries.

A study was undertaken of the effect of chemical and other control methods on the population of parasites, predators, and other natural controlling factors of a series of insect pests. Certain insecticides are very detrimental to the development of the natural enemies, while others have little or no effect upon them. Field stations were established at Moorestown, N. J., Orlando, Fla., and Whittier, Calif., and the pests under investigation are the codling moth, strawberry leaf roller, a series of citrus scale insects, and the citrus whitefly.

PARASITES OF CEREAL AND FORAGE INSECTS

The importation program followed closely that of 1937, with attention paid primarily to parasites of the hessian fly and the European corn borer. Of the first-named, 1,220 adults of *Trichasis remulus* (Walk.) were secured in France and shipped as adults. Parasite work on the corn borer was restricted to securing *Phaeogenes nigridens* Wesm. in Italy. A total of 7,280 host pupae containing the parasite were forwarded late in the summer of 1937. In addition, 1,050 adults of *Chelonus annulipes* Wesm. were received from the Canadian

Department of Agriculture. A shipment of 1,880 adults of *Collyria calcitrator* Grav., a parasite of the black stem sawfly, was received from the same source.

A consignment of 545 field-collected cocoons of *Heterospilus cephi* Roh., a parasite of the European wheat-stem sawfly, was forwarded to the Department of Agriculture of Canada.

Studies were made of the parasites of the vetch bruchid and it was determined that *Triaspis thoracicus* (Curt.), previously imported against the pea weevil, also attacks the vetch bruchid. Accordingly some of the imported material is being utilized against this species.

PARASITES OF COTTON INSECTS

Late in the fall of 1937 a total of 872,340 pink bollworm larvae were collected in Chosen and stored at the Yokohama, Japan, station for parasite development the following spring. From this quantity of host material parasites were reared and shipped to the United States as shown in table 11.

TABLE 11.—*Parasites of the pink bollworm reared in Japan and shipped to the United States in 1938*

Species	Cocoons	Adults	Total
Microbracon nigrorufum Cushman	93,481	832	94,313
Habrobracon pectinophorae Watanabe	1,607		1,607
Chelonus pectinophorae Cushman		154	154
Pristomerus sp.		19	19
Total			96,093

PARASITES OF FOREST INSECTS

Work on parasites of the pine shoot moth and larch casebearer in Europe was brought to a close with the completion of the 1937 collecting program in the Netherlands. In the spring of 1938 an investigation of the spruce sawfly was started in northern Europe. The survey is being made in all countries north of Czechoslovakia to determine the distribution of the pest and the ecological relationships of the pest and its parasites, and to locate new areas for large-scale collection. Promising infestations have already been found in northern Sweden and at the northern limit of spruce growth. This study is in cooperation with the Canadian Department of Agriculture, which has been conducting large-scale collections in central and southern Europe for a period of years.

In Japan collections of sawfly material were made and a shipment of 24,831 field-collected cocoons of *Neodiprion sertifer* (Geoffr.), with 693 tachinid puparia, were forwarded to the Canadian Department of Agriculture. Shipments of European spruce sawfly parasites from that organization to the Bureau totalled 1,300,000 adults of *Microplectron fuscipennis* (Zett.), 8,579 *Exenterus abruptorius* (Thunb.), 120 *E. adspersus* Hart., and 20 *Microcryptus* sp.

One consignment consisting of 1,326 field-collected egg masses of the elm leaf beetle was shipped from Japan to the California College of Agriculture, and from them 5,038 *Tetrastichus* sp. were secured for colonization.

PARASITES OF FRUIT INSECTS

The large-scale importation of oriental fruit moth parasites from Japan and Chosen, initiated in 1932, was discontinued at the end of the 1937 season, shipments during the latter half of that year consisting of 6,237 adults and 2,686 cocoons of 7 species of hymenopterous parasites and 130 tachinid puparia. The 1938 season is being devoted to a study of alternate hosts of the parasites, which appear to be essential to the establishment and maintenance of several of the more important species, and to surveys of new areas. A shipment of 201 cocoons of *Gambrus stokesii* Cam. was received from Australia through the courtesy of the Council for Scientific and Industrial Research.

PARASITES OF TRUCK CROP INSECTS

Shipments of parasites of the lima bean pod borer and the pea weevil continued. Of the pod borer parasites, 90 adults and 3,845 cocoons of *Microbracon*

piger (Wesm.), and 6,004 cocoons of *Phanerotoma planifrons* (Nees) were shipped from the European station at St. Cloud, France. In addition, 20,000 field-collected pod borer larvae and 43,000 larvae of the Mediterranean flour moth, parasitized by *Phanerotoma*, were imported and the parasites reared at the receiving station. A total of 19,854 *Phanerotoma* had emerged from this material by the end of June.

The importations of pea weevil-parasite material consisted of 250 pounds of infested horse beans containing approximately 15,000 of the parasite *Triaspis thoracicus* (Curt.).

COOPERATIVE WORK WITH THE PUERTO RICO AGRICULTURAL EXPERIMENT STATION

The cooperative work with Puerto Rico has been continued and the Division arranged, through cooperation of several other divisions of the Bureau and other organizations, for the shipment of parasites and predators to the island, as listed in table 12.

TABLE 12.—*Shipments of parasites into Puerto Rico, fiscal year 1938*

Host	Parasite or predator	Origin	Shipped
			Number
Bamboo scale	*Chilocorus cacti* L.	Cuba	1,086
Do	*C. platycephalus* Muls.	do	912
Horn fly	*Canthon laevis* Drury	United States	9,548
Lima bean pod borer	*Phanerotoma planifrons* (Nees)	Europe	5,000
Sugarcane borer	*Chelonus annulipes* Wesm.	United States	65,800
Yellow sugarcane aphid	*Coelophora inaequalis* F.	Hawaii	395
Do	*Platyomus lividigaster* Muls.	do	100

COOPERATION WITH FOREIGN ORGANIZATIONS

The Division forwarded directly, or through the cooperation of other divisions of the Bureau, shipments of parasites and predators to the countries listed in table 13.

TABLE 13.—*Shipments of parasites and predators to foreign countries, fiscal year 1938*

Country	Host	Parasite
Bahama Islands	Citrus blackfly	*Cryptognatha* sp.
Canary Islands	Mediterranean fruitfly	*Opius tryoni* Cam.
Egypt	do	Do.
Do	do	*Tetrastichus giffardianus* Silv.
Italy	Oriental fruit moth	*Macrocentrus ancylivorus* Roh.
Peru	Codling moth	*Ascogaster quadridentata* Wesm.
Do	Mealybugs	*Cryptolaemus montrouzieri* Muls.
Uruguay	English grain aphid	*Lysiphlebus testaceipes* (Cress.).

CONTROL INVESTIGATIONS

FUMIGATION OF LIVING PLANT PRODUCTS WITH METHYL BROMIDE

Experimental work on the application of methyl bromide as a fumigant was continued. A fumigation house for strawberry plants was designed and constructed which embodied several new features and was used in the application of this treatment to commercial quantities of strawberry plants for Japanese beetle larvae. In the fumigation of nursery stock for the oriental fruit moth complete mortality of the hibernating insect was obtained at doses of 3½ and 4 pounds of methyl bromide per 1,000 cubic feet for 4 hours at 70° F., and these treatments were tested on some 40 different varieties of 9 species of deciduous nursery stock, approximately 2,000 trees in all. The trees were planted in the nursery and only two or three varieties showed damage from the treatment.

Bare rooted nursery stock of evergreen ornamentals was fumigated in partial vacuum, varieties of juniper, *Taxus*, and arborvitae being used with excellent results.

In the fumigation of farm products for the Japanese beetle methods were developed for applying the treatment in refrigerator cars in the field, and potatoes, onions, tomatoes, sweetpotatoes, and a number of other fruits and vegetables were successfully treated in commercial quantities. Approximately 2,500 carloads of potatoes were fumigated and shipped to market with apparently no injury and at considerably less cost than with the method formerly employed for freeing this and other commodities from adult Japanese beetles.

Methods of fumigating sweetpotatoes with methyl bromide for the sweetpotato weevil were developed experimentally, and some commercial lots were fumigated and planted. It was found possible to kill all stages of the sweetpotato weevil in the potato by fumigation at atmospheric pressures without apparent injury to potatoes for planting purposes. Sweetpotato sprouts shipped in quantity can be fumigated without injury and freed from any stages of the sweetpotato weevil which may be present.

PHYSIOLOGY OF INSECTS

Studies on the normal physiology of insects are under way as a basis for understanding the physiological effects of insecticides and to provide a more intelligent approach to the practical problem of more efficient insecticides and insecticidal control of insect pests. A tentative classification of the mature and developmental forms of blood cells in the southern armyworm was made which shows a considerable difference in the blood cells in the various stages of development of the insect.

The innervation of the hearts of three insects was studied. The comparative susceptibility of these insects to the poisonous effects of nicotine is apparently correlated with the development and complexity of the lateral heart nerves. Insects in which the lateral heart nerves are well developed seem to be more susceptible to nicotine than those in which the lateral nerves are only slightly developed or are not present.

Studies on the southern armyworm indicate that the fat body in the insect, which is supposed to be stored food, is increased when the insect is fed glucose. It is indicated that glycogen is formed from glucose, and that this substance is stored as a reserve food material.

The effect on the histology of the alimentary canal of the southern armyworm produced with various insecticides is being studied. As is to be expected, widely divergent effects by the different poisons were evident.

TESTING OF INSECTICIDES

In cooperation with the Bureau of Plant Industry, in connection with breeding or selecting plants having insecticidal properties, some 880 plant extracts were tested on houseflies and mosquito larvae in a biological assay of the insecticidal value of various selected plants. These plants were pyrethrum- or rotenone-bearing plants, in most cases grown in connection with a project for developing strains with higher insecticide content. Eight hundred and ninety-eight materials were tested on insect pests which feed on the leaves of crop plants. Of these materials, 729 were synthetic organic chemicals and 169 were of plant origin. Seventeen of the materials caused 100-percent mortality in the test insects, which were well-grown specimens of the southern armyworm, while a much larger number caused complete mortality in Colorado potato beetle larvae. Five other insects of economic importance as pests of crop plants were used in tests, and certain of the compounds were tested for their effect on the crop plants.

STUDIES ON NICOTINE FUMIGATION

The results of experimental work on nicotine fumigation show that its efficiency depends on the concentration of the nicotine and the length of exposure, the former being much more important in influencing effectiveness. On certain insects, including the bean and chrysanthemum aphids, the onion thrips, and the American cockroach, nicotine was apparently much more toxic than hydrocyanic acid.

In greenhouse fumigation a method of atomizing nicotine and distributing it throughout the greenhouse was found considerably more effective than the old

tobacco-vapor-smudge method. Vaporization of nicotine in the exhaust pipe of a gasoline engine also gave high concentrations which were effective. Dry conditions in the greenhouse result in somewhat higher concentrations of nicotine, with an increase in insecticidal efficiency with the same dosage.

Atomization of nicotine and its application under canvas trailers was found effective against spinach and pea aphids in the field.

APPLICATION OF INSECTICIDES

Experimental work was continued on methods of applying insecticides from the upper air in the form of dust or dust mixed with adhesive, and a mechanical apparatus was developed for such application, constructed, and mounted in a rotary-winged aircraft. It will be given practical commercial tests in the near future. Various modifications were made in the apparatus for spraying for the gypsy moth, including the redesigning and remodeling of spray equipment for the application of wet insecticides.

INSECTICIDE INVESTIGATIONS

The Division of Insecticide Investigations continued work on all its projects designed to develop new and more effective insecticides. The general work was performed in Washington, D. C., and more specific problems were studied at the six field stations maintained by the Division. Many of the results were made available to the public through the medium of 52 scientific articles, of which 7 appeared in Department publications and the rest in outside journals. Seventeen patents, of which 13 describe new synthetic organic insecticides, were issued to members of the Division, and the monthly review of United States patents relating to pest control was, as usual, issued regularly and distributed to a large list of entomologists, both American and foreign.

CHEMICAL INVESTIGATIONS ON INSECTICIDAL PLANTS (TOBACCO, DERRIS, PYRETHRUM, ETC.) AND THEIR CONSTITUENTS

The study of the constitution of the pyrethrins, which are the active constituents of the very important group of insecticidal preparations made from pyrethrum flowers, was actively continued. Much knowledge of the structure of the side chain was gained, but its exact nature has not yet been determined. Further attempts to obtain the two pyrethrins separately and in pure condition were made with a newly available solvent, and by means of selective adsorption on various powders, but these attempts were unsuccessful. Three scientific articles dealing with the chemistry of the pyrethrins and one concerning their relative toxicity to flies were published.

Different species of *Nicotiana* now commercially unknown and their hybrids with tobacco (*N. tabacum*) were examined for their content of alkaloids. The presence of nornicotine was noted in *N. trigonophylla* and in various hybrids of *sylvestris*×*tabacum*. In addition to nornicotine, *N. trigonophylla* was found to contain a new alkaloid whose nature is not yet fully determined. A new sample of *N. glauca* and several of its hybrids with *N. tabacum* were shown to contain anabasine with small proportions of nicotine. One article concerning certain phases of this work was published.

The study of rotenone-bearing plants was confined to work with derris and cube, which, however, covered several aspects. Upon conclusion of the work on the development of analytical methods, descriptions of the procedures adopted both for extraction of the rotenone and for its recovery from the extract were published, and steps were taken to have them adopted by the Association of Official Agricultural Chemists, an action which will make them the standard methods of the Department. A study was begun of the alkaloidal material occurring in some samples of cube to the extent of 0.1 to 0.2 percent and in derris in lesser amounts, but no information as to its nature is yet available. An investigation was also made of the soluble constituents of derris root in an effort to learn more about the toxicity of this important insecticide to warm-blooded animals. These water-soluble constituents have now been shown to be nontoxic to mice. They contain a large quantity of some sugar, but the absence of a toxic glucoside has been proved.

The study of the constituents of quassia wood was continued, and comparative experiments were made with the four isomers that have been named quassin, neoquassin, picrasmin, and isoquassin. Although their structures have not been fully determined, some progress was made and a report of accom-

plishments will soon be published. Certain species of *Helenium* were also investigated. The results concerning tenulin, a compound present in *H. badium*, will soon be published.

Other plants to which some attention was devoted include *Phellodendron amurense*, *P. lavalli*, *Sapindus drummondi*, and *Madhuca latifolia* or Mowrah meal. The last-named material was found to contain a large quantity of a saponin, which is probably the constituent responsible for the toxicity.

CHEMICAL INVESTIGATIONS TO DEVELOP SYNTHETIC ORGANIC INSECTICIDES

The search for organic compounds capable of being substituted for lead arsenate and other harmful metallic poisons was continued vigorously. Approximately 200 compounds were obtained or synthesized, and submitted to cooperating entomologists for testing against various insects. Three such materials, namely, dibenzothiophene, thiocoumarin, and phenothioxin, were considered of sufficient promise to be applied in small field tests against the codling moth at Vincennes, Ind., but the results of these tests are not yet available.

Phenothiazine continues to hold interest as a possible means of control for codling moth larvae and other insects. Chemical work with it, however, was confined to the determination of residues and an attempt, described later, to find stickers to improve its adherency to foliage. Incidentally, when samples of markedly different degrees of fineness were prepared, it was found by entomologists that their toxic effects on codling moth larvae were radically different, the finest material being the most effective.

Thirteen patents covering the use of various compounds as insecticides were issued to members of the Division.

CHEMICAL INVESTIGATIONS ON THE REMOVAL OF SPRAY RESIDUE

Studies on the removal of spray residues were carried on both in Washington, D. C., and at the field stations in Yakima, Wash., and Vincennes, Ind. It was found that the use of bordeaux mixture increases the difficulty of removing lead arsenate from apples, that there is a varietal effect, and that variations in picking date are relatively unimportant.

A detailed study of derris residues on cabbages was made. The analyses were made by the colorimetric procedure previously developed in this Division. It was demonstrated that the heaviest treatment used left a residue of 0.22 grain per pound, which is less than one-tenth of the quantity reported to have been fed to experimental animals without deleterious effect. No studies of washing technique were made, but analyses made before and after rain indicate that about 90 percent of the residue is easily washed off.

CHEMICAL INVESTIGATIONS TO DEVELOP INORGANIC INSECTICIDES

Because of its importance for the control of the cotton boll weevil, considerable attention was again given to calcium arsenate. One sample was put through an air classifier, and detailed physical and chemical analyses made of the fractions obtained. It was found that, not only was a physical separation into different particle-size ranges accomplished, but there was also a very evident chemical fractionation. The free lime and the basic arsenates accumulated in the finer fractions, with the result that the soluble-arsenic content was greatly different in the various portions. Similar separations were then made on the three types of commercial product undergoing tests in the Division of Cotton Insect Investigations, but the chemical analyses have not yet been made. Some of the fractionated samples were referred to various entomologists for accurate study of their relative toxicities, as part of a general investigation of the relation of particle size to insecticidal effectiveness now being conducted by the Division. Included in this study are samples of lead arsenate and of cryolite prepared to have different average particle sizes, and preliminary reports indicate that, at least for some methods of testing, particle size is of paramount importance.

A study was made of the variation in deposits of lead arsenate among the apple plugs used by one entomologist in testing relative toxicity. A determination was made of the particle-size distribution of all lead arsenates on the market, and fractions of different average particle size were prepared for inclusion in the study of size in relation to toxicity. In connection with the Japanese beetle work effort was continued to develop a chemical method of

estimating the effectiveness of a treated soil, and a greatly enlarged program of testing limonite as a means of correcting damage to soil caused by lead arsenate was started.

CHEMICAL INVESTIGATIONS ON FUMIGANTS FOR CONTROL OF INSECT PESTS

As for several years past, the work on fumigation dealt principally with two subjects, the chemical phases of the control of grain insects at Manhattan, Kans., and the problem of resistant California red scale on citrus at Whittier, Calif.

The work on grain-insect fumigation consisted of studies of the distribution of the fumigants during use and of their retention by the fumigated products. It was found that fumigated rice retains hydrocyanic acid for several days, suggesting that only short exposures may be necessary since the adsorbed fumigant is probably capable of exercising its toxic action over long periods. In conjunction with cooperating entomologists, a device was developed for spraying hydrocyanic acid onto a stream of rice flowing into a bin, and it is hoped that the thorough distribution of this fumigant found by chemical analysis will result in satisfactory insect mortality.

Practically all the work at the Whittier, Calif., station was directed to conducting the large number of experimental hydrocyanic acid fumigations of various stages of the resistant red scale necessary to assist the entomologists in improving their technique to the point where they can be sure that differences found are of real value. Attempts were made to correlate the large differences often found in apparently uniform experiments with conditions of the host lemons, character of the "reservoir" lemons on which the insects are reared, age of the insects, population density, and various other factors.

Three other fumigation problems came in for some study. A large number of nicotine analyses were made for one of the cooperating entomologists who has been studying the dosage-mortality responses of aphids to nicotine vapor, the work leading to a publication describing the fumigation apparatus used. The attempt to find a satisfactory method for determining methyl bromide in vegetable products fumigated with it was continued. A study of the control of stinking smut of wheat by means of gaseous chlorine resulted in the devising of apparatus suitable for controlled experimental treatments.

CHEMICAL INVESTIGATIONS ON ACCESSORY MATERIALS FOR USE WITH INSECTICIDES

The work with accessory materials dealt both with the investigation and intercomparison of wetting and spreading agents in general and with attempts to develop wetters and adhesives for specific insecticides, notably phenothiazine and nicotine peat. The information obtained concerning the wetting and spreading properties of soap solutions made by combining sodium hydroxide and sodium carbonate with *n*-caproic, *n*-caprylic, *n*-capric, lauric, myristic, and palmitic acids was incorporated in two manuscripts, one of which was published, as was another dealing with triethanolamine oleate. The spreading coefficients of 81 additional proprietary detergents, wetting agents, and emulsifying agents were determined and the list published.

It is well established that deposits of phenothiazine heavy enough to be insecticidally sufficient for codling moth control can easily be obtained in the apple orchard; but its adherency is far from satisfactory. Efforts to develop adhesives were made at the Yakima, Wash., Vincennes, Ind., and Beltsville, Md., stations. At Yakima various plastics were tried but proved incompatible. Propylene glycol showed some promise, and kerosene gave good deposits unaccompanied by any injury. At Vincennes rosin residue and calcium soap both showed some promise, but in the case of the calcium soap there was a suggestion of decreased insecticidal effect. Various copper and sulphur fungicides proved of little use. At Beltsville the search for a suitable sticker was made part of a general investigation in which a large number of dispersing agents were first studied and then a few studied more closely. It was found that phenothiazine is probably less stable in the presence of stickers.

Efforts to develop adhesives for nicotine peat at Vincennes proved fruitless. Bentonite appeared to have some value, but probably only because of its own well-known nicotine-holding power.

TESTS TO DETERMINE THE TOXICITY OF NEW INSECTICIDAL COMPOUNDS TO GOLDFISH

The study of the relationship between chemical structure of organic compounds and their toxicity, as revealed by tests with goldfish, was continued with two groups of compounds, the nitrophenols and the halogenated phenols. According to the criterion now used for judging comparative toxicities, orthonitrophenol is the least toxic of the three nitro compounds, being slightly less toxic than the parent compound, phenol. The metanitrophenol is nearly twice as toxic and the para compound about five times as toxic as phenol. Among the halogenated phenols, the chloro and bromo compounds as groups do not differ much, but the iodophenols are appreciably more toxic. In each group the para isomer is the most toxic.

ANALYTICAL INVESTIGATIONS

About 500 routine samples of insecticidal materials submitted by other Divisions of the Bureau were analyzed. In addition, a great deal of investigative work on the improvement of old analytical methods and the development of new ones was conducted.

The adaptation of a blue colorimetric microchemical test for silicon to the determination of fluorine residues was attempted. Distillation carried over fluorine in fixed proportion to silica, and good results were obtained with sodium fluoride and sodium fluosilicate, and the study of the method is being continued.

Significant progress was made in the methods for determining small quantities of arsenic. A digestion procedure using perchloric acid capable of recovering the arsenic from otherwise intractable organic substances was developed, the general unsatisfactory nature of the Gutzeit method was demonstrated by showing that the quantity of mercury laid down in the paper strip used is variable with the best recommended technique of impregnation, and three new procedures to replace the Gutzeit method were devised. One of these, involving isolation of the arsenic by evolution in the form of arsine and absorption in a mercuric chloride solution, followed by colorimetric determination as the blue molybdate compound in a photometer, appears excellent, since it extends the range normally covered by the Gutzeit method to both appreciably smaller and larger quantities. The colorimetric procedure previously developed in this Division for the estimation of phenothiazine deposits was given considerable attention. Some of its limitations, due primarily to easy decomposition, have been recognized, and changes made to circumvent them to some degree.

A possible new method for the estimation of each of the two pyrethrins in pyrethrum powder, based on cleavage of these compounds by hydrogenation to form determinable acids, was devised, the work on the commonly used method of determining rotenone and total extract in derris and cube was brought to a conclusion preparatory to its adoption as the official method of the Department, a new volumetric procedure capable of shortening one of the gravimetric steps in this method was worked out, and a study of the problem of distinguishing derris from cube by microscopical examination or colorimetric chemical tests was started. Two new microchemical methods for nicotine were also developed: one uses brucine to permit the recovery of nicotine from residues of nicotine bentonite, and the other makes use of the pink color developed with cyanogen bromide and α-naphthylamine, which is sensitive enough to permit estimation of the nicotine on an individual apple.

TRANSIT INSPECTION

Inspection activities carried on last year at 18 of the more important railway centers of the United States were extended this year to 3 additional stations. Shipping of nursery stock during the last spring and fall was observed to be considerably in excess of that of the previous year. During the year 1,412,824 shipments of mail, express, and freight were inspected in transit for compliance with Federal domestic plant quarantines, and 4,070 violations were intercepted as compared with 2,678 in 1937. In addition to the regular inspection activities with reference to Federal domestic quarantines, there were noted by transit inspectors, and reported to enforcing organizations, 188 apparent violations of intrastate quarantines relating to pests on account of which Federal quarantines have been established, 50 apparent violations

of the Insect Pest Act, approximately 600 apparent violations of the postal regulation concerning State nursery certification, and many other apparent infringements of State nursery inspection regulations.

The regular force of 17 inspectors was assisted, in periods of heavy shipping, by 15 to 20 inspectors from other projects of the Bureau and by 6 to 9 State inspectors. The assignment of inspectors from the cooperating projects at Boston and New York during the Christmas season resulted in increased interceptions of Christmas trees and evergreen cuttings, including apparently wilful violations of the gypsy moth quarantine.

Table 14 gives data pertaining to shipments intercepted at transit inspection points.

TABLE 14.—*Shipments of nursery stock and other articles intercepted in violation of Federal plant quarantines at transit inspection points, fiscal year 1938*

Station	Shipments intercepted in apparent violation of quarantines relating to—								
	Black stem rust	Gypsy moth and brown-tail moth	Japanese beetle	Pink bollworm	Thurberia weevil	White-pine blister rust	Mexican fruitworm	Dutch elm disease	Total
Atlanta		1	48				7		56
Boston		488	255			4			747
Buffalo			12						12
Chicago	1	79	199	1	1	17	57		355
Cincinnati		4	27	3		3	39		76
Cleveland		3	3				1		7
Columbus, Ohio							1		1
Dallas			1	3			18		22
Detroit		45	9						54
Indianapolis		1					2		3
Jacksonville		12	110						122
Kansas City		14	89	4	3	2	90		202
Memphis		1	1	2		2	14		20
New York		428	687			13		1	1,129
Omaha		24	168			8	6		206
Philadelphia		42	177			9	18		246
Pittsburgh	1	10	345			6	45		407
St. Louis		6	50			3	134		193
St. Paul		1	2				4		7
Springfield, Mass		127	37						164
Washington, D. C		8	31			2			41
Total	2	1,294	2,251	13	4	69	436	1	[1] 4,070

[1] The total number of violations represents 3,975 shipments, of which 87 were in violation of 2 quarantines and 4 were in violation of 3 quarantines.

TERMINAL INSPECTION OF MAIL SHIPMENTS

The States of Arkansas and Oregon have availed themselves of the provisions for enforcing certain State quarantines through postal channels, as provided in the amendment (act No. 643 of June 4, 1936) to the law relating to terminal inspection of mail shipments of plants and plant products.

The terminal-inspection procedure which has been in effect for several years, and which provides for turning back or disinfecting mail shipments of plants and plant products if found infested, is continued in Arizona, California, the District of Columbia, Florida, Hawaii, Idaho, Louisiana, Mississippi, Montana, Oklahoma, Oregon, Puerto Rico, Utah, and Washington.

CONVICTIONS AND PENALTIES IMPOSED FOR VIOLATIONS OF THE PLANT QUARANTINE ACT

The following convictions and penalties imposed for violations of the Plant Quarantine Act were reported to the Bureau:

Gypsy moth and brown-tail moth quarantine: One conviction, with fine of $25.

Japanese beetle quarantine: Twenty convictions, with fines aggregating $600.

White-pine blister rust quarantine: One conviction, with fine of $130.

Quarantines affecting Mexican plants and plant products: Fines aggregating $414.40 were imposed by customs officials on the Mexican border against 310 persons caught attempting to smuggle in from Mexico prohibited plants and plant products.

FOREIGN PLANT QUARANTINES

The Division of Foreign Plant Quarantines is engaged in the enforcement of quarantines and regulatory orders of the Department prohibiting or restricting the entry of various plants and plant products entering the United States, the maintenance of a certification service to inspect and certify plants and plant products to meet the sanitary requirements of foreign countries, and, in addition, the enforcement of such domestic quarantines as affect the movement of plant material between the Territories of Hawaii and Puerto Rico and continental United States.

Plant-quarantine inspectors and collaborators are stationed at the more important ports of entry and at points distributing foreign mail, and work in close cooperation with employees of the Treasury and Post Office Departments.

The rules and regulations covering the importation of cotton and cotton wrappings into the United States were modified, effective December 11, 1937, to permit the movement of cotton from one approved customs port where plant-quarantine requirements can be met to another for fumigation.

MARITIME PORT INSPECTION

SHIP INSPECTION

Ships from foreign countries and also those from Hawaii and Puerto Rico and the coastwise ships that pass through the Panama Canal are inspected promptly on arrival for the presence of prohibited and restricted plant material in passengers' and crews' baggage, ships' stores, quarters, and cargo.

The inspection at ports in California, Florida, and Hawaii and at certain ports in Puerto Rico has been performed by State and Territorial officials serving as collaborators of the Bureau.

A record by ports of the ship inspection appears in table 15.

TABLE 15.—*Number of ships inspected, fiscal year 1938*

Port	From foreign ports											
	Direct			Via United States ports			Via Hawaii			Via Puerto Rico		
	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material
Baltimore	739	738	303	908	897	431						
Bellingham	36	36	8									
Boston	1,224	1,219	540	360	359	158						
Brownsville	3	3	3	6	6	3						
Brunswick [1]	2	2	1									
Buffalo	7	7	6									
Charleston	188	188	88	174	169	67				1	1	0
Chicago	12	12	6									
Detroit	22	22	14									
Eureka [2]	2	2	1	9	9	2	1	1	0			
Galveston	516	516	327	518	517	286				3	3	2
Guam	25	22	11	2	2	0						
Gulfport [2]	16	15	13	103	26	15						
Honolulu [2]	235	235	106	6	6	0						
Houston	520	519	413	459	451	253						
Jacksonville [2]	243	243	23	122	122	0				2	2	0
Key West [2]	153	145	75	30	25	2						
Miami [2]	1,435	1,434	443	28	28	15				2	2	1
Mobile	309	309	134	405	387	171						
New Orleans	1,445	1,444	797	470	470	301	1	1	1			
Newport News	105	105	74	349	345	157						
New York	3,681	3,644	2,075	1,033	921	458				125	125	85
Norfolk	336	336	185	748	747	354				1	1	0
Pensacola [2]	46	46	20	181	181	78						
Philadelphia	737	737	356	1,101	1,089	604						
Port Arthur	478	478	384	318	318	132						
Portland, Oreg	104	104	81	323	301	183	1	1	1			
Port San Luis [2]	71	71	46				1	1	0			
Puerto Rico (all ports)	1,077	1,070	302									
San Diego [2]	1,273	1,272	53	18	18	4						
San Francisco [2]	358	358	229	760	760	346	92	92	62			
San Pedro [2]	1,479	1,476	900	462	460	176	64	64	35	7	7	5
Savannah	126	126	77	197	197	107						
Seattle	1,159	1,040	245	248	248	161	2	2	2			
Tampa [2]	292	292	109	308	308	92						
Ventura [2]	3	3	0									
West Palm Beach [2]	167	167	6	10	10	0						
Total	18,624	18,436	8,454	9,656	9,377	4,556	162	162	101	141	141	93

TABLE 15.—*Number of ships inspected, fiscal year 1938*—Continued

Port	From Hawaii						From Puerto Rico						From United States ports		
	Direct			Via United States ports			Direct			Via United States ports			Via Panama Canal		
	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material
Baltimore	1	1	1	51	51	0	7	7	0	23	23	0	223	222	2
Bellingham	1	1	1												
Boston	1	1	0	16	16	0	17	17	0				206	206	1
Charleston							3	3	0	21	21	1	28	28	0
Eureka [2]				7	7	0							2	2	0
Galveston				5	5	1	10	10	1	7	7	1	13	13	0
Guam	12	11	9												
Gulfport [3]										10	2	0			
Honolulu [2]													98	98	0
Houston	3	3	0	3	3	0	6	6	0	8	8	0	51	51	0
Jacksonville [2]							22	22	0	5	5	0	16	16	1
Miami [2]							1	1	0						
Mobile	3	3	1	7	7	0	29	29	3	52	48	0	72	72	0
New Orleans	5	4	2	12	12	2	24	24	3	52	52	2	65	65	6
Newport News							2	2	0	5	5	0	9	9	0
New York	15	15	2	48	40	2	103	100	17	9	6	1	302	255	1
Norfolk							14	14	1	39	38	1	110	110	2
Pensacola [2]							1	1	0	6	6	0			
Philadelphia	1	1	1	35	34	0	36	36	8	13	13	2	315	308	2
Port Arthur							14	14	2	10	10	0	21	21	1
Portland, Oreg	1	1	0	10	10	0									
Port San Luis [2]	12	12	1										1	1	0
Puerto Rico (all ports)													6	6	1
San Diego [2]	86	86	8	1	1	0							152	151	6
San Francisco [2]	182	182	34	30	30	2							584	584	13
San Pedro [2]	124	124	25	53	53	7	1	1	1				776	773	115
Savannah				2	2	0	17	17	1	18	18	0	21	21	1
Seattle	9	8	2	5	2	1									
Tampa [2]							24	24	2	2	2	0			
Ventura [2]	4	4	1												
Total	460	457	88	285	273	15	331	328	39	280	264	8	3,071	3,012	152

[1] Work handled by inspector stationed at Savannah, Ga. [2] Collaborators stationed at these ports. [3] Work handled by inspectors stationed at Mobile, Ala.

Note: The foreign ship arrivals do not in all cases agree with customs figures. Foreign ships may put in for bunkers and be inspected by inspectors of the Bureau of Entomology and Plant Quarantine but not entered by customs. On the other hand, ships entered at certain small subports are included in customs records but not in this report.

CARGO INSPECTION

All importations of plants and plant products subject to plant-quarantine restrictions are inspected at the port of entry or at the port of first arrival. The table pertaining to cargo inspection (table 16) has been enlarged somewhat and includes, in addition to the number of lots of plant material inspected at each port, information on the amounts of the various classes of commodities imported.

TABLE 16.—*Summary of importations of plants and plant products inspected, fiscal year 1938*

Port	Fruits and vegetables			Nursery stock and seeds			Bagging, cotton, cotton products			Bagasse, broomcorn, corn, rice fiber, etc.		
	Lots	Containers	Additional quantities	Lots	Containers	Additional quantities	Lots	Bales	Additional quantities	Lots	Bushels	Additional quantities
Baltimore	233	273	4,598,134 bunches, 99,758 pounds.	189	7,149	3,363 pounds	19	1,379	2,891,000 pounds	8	838,246	
Bellingham	18		6,185 bunches	43	8,923	7 trucks				2	70,531	
Blaine	7	276	1,050 bushels	71	630	100 units, 882 pounds	1	1				
Blaine, for export				6	9							
Boston	319	78,116	3,685,744 bunches	127	2,424	2,245 pounds	1,036	65,465	14,898 bags, 420 packages.	17	1,373,386	1,227 bales.
Boston, for export							11	1,015		7		2,602 bales.
Brownsville	617	11,133	17,317 pounds, 74,322 bunches.	4	700	1 pound	10		952,990 pounds	15	51	14 bales.
Brownsville, for export							55	3,016	3,043,744 pounds			
Buffalo	42	1,327		78	85	4,676 pounds	31	1,074	5 packages	111	4,075,870	
Calexico	34	1,537	29,626 pounds				404	63,210	12,339,016 pounds			
Calexico, for export	3	22	54,420 pounds				1		55 pounds			
Charleston	134		1,508,745 bunches	1	150		34	3,551		103	11,024,202	4 bales, 4 cases.
Chicago	27	21,496		3	85		3	14				
Del Rio	31	53										
Detroit	31	11,612		221	1,151	1,419 units, 15 pounds.	211	6,600		12	2,333	3 cases.
Douglas	1									12	38	
Eagle Pass	574	18,413	6,561 bushels							4		83 bales.
El Paso	4,183	72,449	2,426,383 pounds, 1,702,696 bunches.	7	16	3 units	29	704	155,238 pounds, 7 packages, 11 cans.	3	1,268	
El Paso, for export	7	21		8	12		1	1		12	79	
Galveston	168	1,919	3,474,790 bunches, 5,436 fruits.	1	36		153	53,856				
Gulfport [1]							5	460				
Hidalgo	295	388					2		4 bags	6	6	2 bags.
Honolulu [2]	633	5,253		126	308	44 pounds				24	195	5 bags.
Honolulu, for export	6	45								2		21 bags.
Houston				5	422		216	65,797		1	255,000	
Jacksonville [2]	175	60,671	1,982,892 bunches	2	4					7	107,307	
Jacksonville, for export	40	11,950										
Key West [2]	478	30,370	84 fruits, 2,185 bunches.									
Laredo	2,370	315,653	1,462,510 bunches	1	1							
Mercedes										10	27	
Miami [2]	1,083	721,818	396,919 bunches, 2,953 fruits.	12		303 pounds				3	17	
Mobile	155	288	3,703,211 bunches, 2,000 pounds.	24	24,868		48	11,982		15	577,139	
Naco, for export							1		284 units	1		2 units.

New Orleans	1,655	293,485	15,143,787 bunches, 284,720 pounds, 120 fruits.	36	27,552		123	29,000	1 package	27	1,901,457	
New Orleans, for export	95	30,869		1	1							
Newport News	1	3,200		5	300							
New York	9,947	3,829,908	11,930,078 bunches, 290 pounds, 6,992 fruits.	1,534	78,655	44,091 pounds	986	158,008	493 packages	148	2,896,889	680 miscellaneous containers, 571 bales.
New York, for export	850	338,041		73	623		563	65,196	38,637 bags, 243 packages.	36	12,096	5,053 bales, 130 bags, 25 miscellaneous containers.
Niagara Falls [3]	226	3,538		253	134	14,075 units	171	2,535	508 bundles, 31 bags	2	2	
Nogales	3,146	1,458,211	7,619 fruits, 390 bunches, 88 pounds	6	12	339 units				3	2,368	300 dozen.
Norfolk	66		496,893 bunches	28	2,908		89	12,175		2	43,491	
Pensacola [2]	3		23,302 bunches									
Philadelphia	167	18,238	5,017,992 bunches	106	9,977	1,429 pounds	67	5,926		19	1,045,271	
Philadelphia, for export				1	7		1	60				
Port Huron [2]	21	3,677	2,025 bunches	34	96	92 units, 200 pounds						
Portland	3	25,078		30	1,396	2,800 pounds	12	1,338	6,000 bags	15	655,270	
Presidio	1	1								2	1	4 bags.
Providence [4]	1		16,696 bunches				17	2,814				
Puerto Rico	336	69,126	42 bunches	73	76	2,660 pounds, 262 units.	1		556 bags	269	360,166	33 bales.
Puerto Rico, for export	4	1,214								11	540	
Roma										1		1 bundle.
St. Paul							6	42				
San Diego [2]	4	25	26,246 bunches									
San Francisco [2]	1,424	23,615	1,772,507 bunches	443	4,652	16,038 pounds	95	7,699	7,000 bags, 6 packages.	17	1,360,063	
San Francisco, for export.	13	17	670 bunches	7	73		5	313				
San Pedro [2]	306	18,507	1,835,003 bunches	79	2,230	15,071 pounds	71	9,891	2,000 bags, 4 packages.	34	1,164,894	
San Pedro, for export				5	15		1	100				
San Ysidro	61	1,759		8		168 units				1		6 bags.
San Ysidro, for export	17	11,334										
Sault Ste. Marie [5]	11	15	2,035 bunches							1		3 bags.
Savannah	15		76,954 bunches	9	2,203		33	4,149	2,023 bales			
Seattle	398	120,920	499,393 bunches	373	61,739	14,804 pounds, 1,406 units.	41	3,387	56 bundles	32	1,239,147	
Seattle, for export	5	18		20	1,761		5	306				
Tampa [2]	1,458	99,223	654,985 bunches, 305 fruits.							3	84,963	
Total	31,898			4,053			4,558			998		
Total all lots, 41,485.												

[1] Work handled by inspectors stationed at Mobile.
[2] Collaborators stationed at these ports.
[3] Work handled by inspector stationed at Buffalo.
[4] Work handled by inspector stationed at Boston.
[5] Handled through customs.

In addition to the above, 1,777 lots of plant material were entered at Canadian border ports where no plant-quarantine inspectors are stationed, through the cooperation of the customs officers and of the Division of Foreign Pests Suppression of the Canadian Department of Agriculture. This material consisted of 21 lots representing 2,335 bunches of bananas and 630 containers of other fresh fruits and vegetables not of Canadian origin; 404 lots consisting of 10,627 bales of bagging, cotton, and cotton products; 454 lots totaling 4,113,912 bushels of corn; and 177 lots consisting of 898 containers and 600 individual plants entering under regulation 15 of Quarantine No. 37.

In addition to the importations credited to the Mexican border ports, there were several thousand importations of permitted fruits and vegetables in such small quantities that no entries were required by customs and no records of them have been kept. All these small importations were carefully inspected before being released and, taken as a whole, they represent a very considerable amount of work, especially at the larger ports.

At many of the ports considerable time was devoted to the inspection of packing materials used with various commodities to determine compliance with Quarantine No. 69. As a result of such inspection many interceptions of prohibited packing material were made. The straw jackets on many shipments of imported liquors were found to be contaminated with vetch plants bearing seed infested with living bruchids. All jackets in which living bruchids were found were required to be removed and destroyed or given the fumigation approved for imported vetch seed found to be infested with living bruchids.

DISINFECTION

Disinfection is required of certain commodities as a condition of entry and of other commodities when inspection reveals the presence of injurious insects or plant diseases. The following plant material was treated under the supervision of inspectors and collaborators of this Bureau:

Cotton	bales	141,791
Cotton waste	do	16,992
Cotton linters	do	10,107
Cotton samples	packages	793
Cottonseed fiber	bales	1,301
Bagging	do	7,516
Broomcorn	do	1,173
Rice fiber	do	405
Vetch	bags	4,873
Tree seeds	lots	56
Miscellaneous plants	do	837
Narcissus	cases	7,484
Chestnuts	do	5,616
Cipollino	do	3,697
Acorns	do	20

In addition to the foregoing, various shipments of plant material and cotton samples were treated at the inspection house in Washington, D. C., as shown in table 19.

AIRPLANE INSPECTION

There was a marked increase in the number of airplanes inspected compared with the preceding year. A total of 4,262 airplanes were inspected, representing an increase of 941, or 28 percent. Airplane inspections were made at the following 19 ports of entry. Douglas and Nogales, Ariz.; Calexico, Los Angeles, San Diego, and San Francisco, Calif.; Key West, Miami, Pensacola, and West Palm Beach, Fla.; Agana, Guam; Honolulu, T. H.; Baltimore, Md.; New York, N. Y.; San Juan, P. R.; Brownsville, El Paso, and Laredo, Tex.; and Seattle, Wash. As a result of these inspections 998 interceptions of prohibited and 233 interceptions of restricted plant material were taken from 998 airplanes.

FOREIGN PARCEL-POST INSPECTION

Through cooperation with customs and post-office officials, foreign mail packages found to contain plants or plant products are referred to inspectors of this Bureau for examination. Such packages arriving at ports of entry where no plant-quarantine inspectors are stationed are forwarded to the nearest port where inspection can be made.

A record by port of the number and disposition of foreign parcel-post packages inspected appears in table 17.

TABLE 17.—*Foreign parcel-post packages inspected, fiscal year 1938*

Port	Inspected	Refused entry (entire or in part)	Diverted to Washington	Released under permit	Port	Inspected	Refused entry (entire or in part)	Diverted to Washington	Released under permit
Atlanta [1 2]	12	1	8	1	Miami [1]	147	22	71	3
Baltimore	1,361	26	131	74	New Orleans [6]	231	13	79	13
Boston	6,082	116	751	98	New York	166,644	587	5,549	399
Brownsville	1,005	2	1	0	Nogales [6]	520	10	8	3
Buffalo	1,622	18	423	32	Philadelphia	8,080	134	671	133
Chicago	12,919	239	446	144	Portland [7]	677	23	0	31
Detroit	4,817	99	126	166	Puerto Rico (all ports)	26	5	0	14
Eagle Pass	275	0	0	0	St. Paul	15,134	56	68	65
El Paso [3]	462	25	32	3	San Diego [1]	80	4	0	14
Galveston	7	0	7	0	San Francisco [1]	6,415	92	7	759
Guam	103	0	0	0	Seattle	1,583	50	3	295
Honolulu [1]	1,719	149	0	148	Tampa [1]	10	3	2	0
Houston [4]	171	5	18	0	Washington	1,696	23	0	539
Jacksonville [1]	96	5	12	8					
Key West [1]	5	0	0	0	Total	236,245	1,817	8,448	2,995
Laredo	394	48	26	2					
Los Angeles [1 5]	3,952	62	9	51					

[1] Collaborators are stationed at these ports.
[2] Opened Jan. 8, 1938.
[3] 3 packages were diverted to San Francisco for disposition.
[4] 145 packages (cotton samples) were diverted to Brownsville for fumigation.
[5] 95 packages were diverted to San Francisco for disposition.
[6] 1 package was diverted to San Francisco for disposition.
[7] 14 packages were diverted to Seattle for disposition.

It has been the policy for a number of years to admit shamrocks through the mails provided they are free from soil. Large numbers are brought in in this manner each year and they have been included in table 17. Of the number of packages listed as inspected, the following represent shamrocks: Baltimore, 48; Boston, 1,696; Buffalo, 18; Chicago, 3,653; Detroit, 203; Los Angeles, 96; New York, 92,900; Philadelphia, 1,308; St. Paul, 469; San Francisco, 241; Seattle, 203.

MEXICAN-BORDER SERVICE

The increase in travel between Mexico and the United States noted in the last annual report continued through the year. Practically all activities at Mexican border ports showed gains. The number of freight cars entering from Mexico increased from 32,050 in 1937 to 35,141 in 1938. The car fumigations increased from 8,226 to 9,953. Cars to the number of 2,874 were found contaminated with cottonseed this year whereas the total found contaminated last year was 2,034. All cars found contaminated with cottonseed were required to be clean before entry was permitted. The usual fee of $4 was charged for each car fumigated, and all fees collected were covered into the Treasury as miscellaneous receipts.

A summary of the railway-car inspection and fumigation is shown in table 18.

TABLE 18.—*Inspection and fumigation of railway cars crossing the border from Mexico, fiscal year 1938*

Port	Cars inspected	Cars with cottonseed	Cars entered	Cars fumigated	Fees collected	Port	Cars inspected	Cars with cottonseed	Cars entered	Cars fumigated	Fees collected
	Number	*Number*	*Number*	*Number*	*Dollars*		*Number*	*Number*	*Number*	*Number*	*Dollars*
Brownsville	493	1	490	45	188	Naco	652	5	652	1	4
Douglas	1,913	6	1,913	64	256	Nogales	5,772	200	5,587	1,418	5,800
Eagle Pass	2,306	162	2,219	839	3,400	Presidio	324	29	315	83	336
El Paso	11,150	228	10,658	[1] 1,668	6,528						
Laredo	15,067	2,243	13,307	5,835	22,600	Total	37,677	2,874	35,141	9,953	[2] 39,112

[1] Includes 6 cars not from Mexico.
[2] The apparent discrepancy in fees collected and the number of cars fumigated may be explained by the fact that it is customary for the railroads to purchase fumigation coupons in advance.

In addition to the freight cars listed in table 18, 4,839 pullman and passenger coaches entered and were inspected at the following ports: El Paso, 1,199; Laredo, 3,121; Nogales, 517; and Presidio, 2.

Plant-quarantine inspectors at Mexican border ports, in cooperation with the customs service, devote much time to the inspection of vehicles, baggage, personal effects, and express packages from Mexico.

A total of 336,695 pieces of baggage and 3,876,192 vehicles were inspected. Large quantities of prohibited and restricted plant material were intercepted as a result of these inspections. A record of these interceptions appears in table 21.

INSPECTION IN PUERTO RICO AND HAWAII

Plant-quarantine inspectors stationed in Puerto Rico enforce the provisions of Quarantine No. 58, governing the movement of fresh fruits and vegetables to the mainland, in addition to the enforcement of foreign plant quarantines and regulations as they affect the entry of foreign plants and plant products into the island. Valuable assistance is rendered by insular inspectors serving as collaborators, especially in that portion of the work pertaining to the enforcement of the foreign plant quarantines.

In connection with the enforcement of Quarantine No. 58, inspections are made in the orchards and fields, in packing houses, and on the docks, of such fruits and vegetables as are permitted to move to the mainland. During the year 2,221 shipments consisting of 590 bunches of bananas, 432,992 crates of pineapples, and 14,426,534 pounds of other approved fruits and vegetables were certified for such movement. Through cooperation with post-office officials, parcel-post packages destined for points on the mainland are inspected at the four main post offices on the island. This arrangement makes it possible to intercept much prohibited plant material before it leaves the island and reduces considerably the number of Puerto Rican mail packages requiring inspection upon arrival at New York. A total of 2,983 parcel-post packages were examined and 200 were found to contain prohibited plant material and were returned to the sender.

In Hawaii the enforcement of foreign plant quarantines is handled wholly by insular inspectors serving as collaborators. The inspectors of this Bureau stationed in the Hawaiian Islands are engaged in the enforcement of Quarantine No. 13, which governs the movement of fresh fruits and vegetables to the mainland. During the year 1,918 shipments consisting of 104,855 bunches of bananas, 39,079 crates of pineapples, 41,470 coconuts, and 5,211,484 pounds of other approved fruits and vegetables were inspected and certified. These inspections took place in the fields, in packing houses, and on the docks.

Considerable time was devoted to the inspection of parcel-post packages destined for points on the mainland and 107,820 such packages were opened and inspected while the plant-quarantine status of 212,211 additional packages was determined by other means. One hundred and thirty-one packages were found to contain prohibited plant material.

Other activities in Hawaii consisted of the inspection and sealing of 3,329 pieces of baggage leaving Hawaii by boat, 1,367 pieces of baggage leaving by airplane, 3,048 air-express packages, 392 express packages leaving by boat, and 49 airplanes, all destined for points on the mainland.

INSPECTION OF SPECIAL-PERMIT AND DEPARTMENTAL PLANT MATERIAL

Importations of propagating plant material are inspected at special ports of entry designated for that purpose. Most of the special-permit importations, however, are inspected and treated at the inspection house in Washington, D. C.

Departmental importations and plant-propagating material distributed by the Department are also inspected at the inspection house, and shipments of domestic plants entering and leaving the District of Columbia are also examined for injurious pests. A summary of the inspections and treatments of nursery stock at the inspection house appears in table 19.

TABLE 19.—*Summary of plants and plant products offered for inspection in the District of Columbia, fiscal year 1938*

Material inspected	Foreign	Domestic	Fumigated	Otherwise treated	Infested with insects	Infected with diseases
Lots of seeds (departmental)	5,283	12,300	11,001	764	73	62
Plants, cuttings, bulbs, roots, rhizomes, etc. (departmental)	9,424	232,396	5,979	11,364	[1] 584	[1] 1,215
Miscellaneous unclassified material, other than plants and seeds (departmental)	87	57	70	2	2	1
Shipments of plants under regulation 14, Quarantine No. 37 (commercial)	3,361	0	360	99	489	750
Shipments of plants and plant products under regulations 3 and 15, Quarantine No. 37 (commercial)	1,349	----------	246	194	157	25
Containers of domestic plants other than departmental (mail, express, freight, and truck)	----------	13,019	----------	4	51	2
Shipments of plants by private individuals	----------	3,227	9	25	47	35
Interceptions of plants and plant products at Washington	1,697	----------	16	36	18	1
Interceptions of plants and plant products referred to Washington	1,403	----------	160	652	117	20
Parcels of cotton samples referred to Washington	13,178	----------	13,178	----------	----------	----------

[1] Lots.

INSPECTION OF PLANT-INTRODUCTION AND PROPAGATING GARDENS

Plant material which is being propagated at plant-introduction gardens maintained by the Bureau of Plant Industry is inspected at regular intervals for the presence of plant pests. Plant material distributed from the plant-introduction garden at Coconut Grove, Fla., was inspected by State officials cooperating with this Bureau. The inspections at the plant-introduction garden at Chico, Calif., were handled jointly by an inspector of this Bureau and an entomologist from the California State Department of Agriculture. Material distributed from the District of Columbia, Maryland, and Savannah, Ga., was inspected by inspectors of the Bureau. A summary of these inspections appears in table 20.

TABLE 20.—*Plants, budsticks, cuttings, tubers, roots, and shipments of seeds examined for distribution from plant-introduction and propagating gardens, fiscal year 1938*

Station	Plants	Budsticks, cuttings, tubers, and roots	Shipments of seeds	Station	Plants	Budsticks, cuttings, tubers and roots	Shipments of seeds
Bell, Md.	56,821	741	14	District of Columbia	10,645	6,538	10,401
Chico, Calif.	9,330	775	94	Mandan, N. Dak.	591,807	----------	----------
Coconut Grove, Fla.	4,284	355	41				
Savannah, Ga.	1,262	309	2	Total	674,149	8,718	10,552

INTERCEPTIONS OF PROHIBITED AND RESTRICTED PLANTS AND PLANT PRODUCTS

The inspection of ships, airplanes, vehicles, cargo, baggage, ship's stores and quarters, and foreign mail packages at the maritime and Mexican and Canadian border ports resulted in the interception of large quantities of prohibited and restricted plant material. Many of these interceptions were found to be infested with insects or infected with plant diseases; many others, while showing no infestation or infection, must be considered potentially dangerous since they are known hosts of pests in the country of origin. In classifying the interceptions, those made at bridges and crossings at the Mexican and Canadian border ports have all been considered as having been taken from baggage. A record of the number of interceptions of prohibited and restricted plant material appears in table 21.

TABLE 21.—*Number of interceptions of prohibited and restricted plants and plant products, fiscal year 1938*

Port	In baggage		In cargo		In mail		In quarters		In stores		Total	
	Prohibited	Restricted	Prohibited	Restricted	Prohibited	Restricted	Prohibited	Restricted	Prohibited	Restricted	Prohibited	Restricted
Baltimore	8	13	48	0	29	3	71	10	165	1	321	27
Bellingham							1	1	2	1	3	2
Blaine	1,341	783									1,341	783
Boston	107	161	13	7	74	63	7	9	20	1	221	241
Brownsville	6,176	688			1	0					6,177	688
Buffalo [1]	3	949	1	1	14	7					18	957
Calexico	2,834	62									2,834	62
Charleston	17	0	3	0			30	2	16	0	66	2
Chicago			16	16	188	58	0	1			204	75
Del Rio	513	132									513	132
Detroit	35	408	4	3	66	48					105	459
Douglas	430	55									430	55
Eagle Pass	1,288	214									1,288	214
El Paso	6,905	1,142			24	14					6,929	1,156
Galveston	1	2					441	7	97	1	539	10
Guam	1	0	4	0					26	0	31	0
Gulfport [2]			0	1			11	0	6	0	17	1
Hidalgo	2,749	419									2,749	419
Honolulu [3]	784	273	96	419	142	118			40	4	1,062	814
Houston	11	0	7	0	3	0	417	0	62	0	500	0
Jacksonville [3]	0	1			4	1	17	6	18	2	39	10
Key West [3]	60	136	0	1			20	94	1	1	81	232
Laredo	14,888	1,346			36	10					14,924	1,356
Los Angeles [3]	1	0			46	18					47	18
Mercedes	303	31									303	31
Miami [3]	1,907	778	37	9	14	9	787	386	103	7	2,848	1,189
Mobile	9	4	0	5			178	0	69	2	256	11
Naco	151	37									151	37
New Orleans	320	135	11	7	12	5	906	107	171	5	1,420	259
Newport News			1	1			38	2	17	0	56	3
New York	2,701	1,598	541	88	472	183	151	30	84	3	3,949	1,902
Nogales	3,461	726			3	7					3,464	733
Norfolk	12	2	1	0			137	8	32	1	182	11
Pensacola [3]							12	0	9	0	21	0
Philadelphia	25	13	11	1	125	15	89	23	115	10	365	62
Port Arthur	17	3					1,028	0	195	0	1,240	3
Port Huron [3]	2	128									2	128
Portland			10	3	15	8	3	1	16	2	44	14
Port San Luis [3]							3	0			3	0
Presidio	186	39									186	39
Puerto Rico (all ports)	60	85	1	0			2	1	1	1	64	87
Roma	151	28									151	28
St. Paul					36	23					36	23
San Diego [3]	8	5	2	3	3	0	29	9	67	10	109	27
San Francisco [3]	185	12	6	1	50	41	161	0	118	3	520	57
San Pedro [3]	355	33	13	1			94	6	166	6	628	46
San Ysidro	6,420	510									6,420	510
Savannah							118	0	13	0	131	0
Seattle	249	36	26	0	22	9	12	0	20	1	329	46
Tampa	4	6			0	3	13	0	29	0	46	9
Ventura [3]									1	0	1	0
West Palm Beach [3]	0	1					1	7			1	8
Total	54,678	10,994	852	567	1,379	643	4,777	710	1,679	62	63,365	12,976

[1] Includes interceptions made at Niagara Falls.
[2] Work handled by inspectors stationed at Mobile.
[3] Collaborators stationed at these ports

PESTS INTERCEPTED

The inspectors and collaborators of the Bureau collected from foreign plants and plant products insects belonging to 1,062 recognized species and others distributed among 930 genera and families, fungi and bacteria belonging to 304 recognized species, plant-parasitic nematodes belonging to 11 recognized species, and numbers of interceptions of diseases caused by fungi, bacteria, viruses, or other agents that could be referred to family, genus, or other group only. Many of these interceptions were of economic importance or of scientific interest, or both.

A total of 49,930 interceptions of insects and plant diseases were made during the year. A summary of the interceptions appears in table 22.

TABLE 22.—*Number of interceptions of insects and plant diseases made during the fiscal year 1938*

Port	Cargo		Stores		Baggage		Quarters		Mail		Total	
	Insects	Diseases	Insects	Diseases	Insects	Diseases	Insects	Diseases	Insects	Diseases	Insects	Diseases
Baltimore	53	15	55	56	3	6	9	5	25	5	145	87
Bellingham	8	1	0	1	0	0	0	0	0	0	8	2
Blaine	1	0	0	0	14	12	0	0	0	0	15	12
Boston	99	121	157	313	67	28	7	8	91	44	421	514
Brownsville	2,045	93	28	19	7,520	474	26	0	1	0	9,620	586
Buffalo	36	30	0	4	3	1	0	0	18	8	57	43
Calexico	2	0	0	0	43	0	0	0	0	0	45	0
Charleston	13	2	8	21	3	1	1	2	0	0	25	26
Chicago	50	3	3	1	0	0	0	0	24	1	77	5
Del Rio	0	0	0	0	15	0	0	0	0	0	15	0
Detroit	22	33	0	0	2	0	0	0	21	10	45	43
Douglas	0	0	0	0	23	2	0	0	0	0	23	2
Eagle Pass	92	20	0	0	112	9	0	0	0	0	204	29
El Paso	125	19	0	0	147	83	0	0	6	3	278	105
Galveston	83	14	25	472	1	0	5	3	0	0	114	489
Guam	0	0	3	0	0	0	343	0	0	0	346	0
Hidalgo	80	13	0	0	510	2,375	0	0	0	0	590	2,388
Honolulu	433	5	3	0	213	0	350	0	318	0	1,317	5
Houston	11	4	25	576	1	0	0	1	1	0	38	581
Jacksonville [1]	12	0	30	74	0	0	7	1	3	1	52	76
Key West [1]	0	0	0	0	25	3	1	1	0	0	26	4
Laredo	2,488	5	0	0	561	14	0	0	4	0	3,053	19
Los Angeles [1]	1	0	0	0	0	0	0	0	9	0	10	0
Mercedes	0	0	0	0	278	3	0	0	0	0	278	3
Miami [1 3]	100	8	39	17	476	16	155	3	4	0	774	44
Mobile [2]	61	4	27	241	0	1	7	2	0	0	95	248
Naco	0	0	0	0	28	1	0	0	0	0	28	1
New Orleans	560	32	135	93	66	8	52	9	2	1	815	143
Newport News	4	0	13	39	0	0	0	1	0	0	17	40
New York	2,029	3,029	324	341	635	337	63	42	685	118	3,736	3,867
Nogales	2,724	656	0	0	1,440	150	0	0	4	0	4,168	806
Norfolk	102	32	29	192	0	1	0	3	0	0	131	228
Pensacola [1]	0	0	5	3	0	0	5	0	0	0	10	3
Philadelphia	74	256	151	900	11	21	27	58	83	79	346	1,314
Port Arthur	0	0	86	363	0	0	9	5	0	0	95	368
Portland	3	1	2	2	0	0	0	0	4	1	9	4
Presidio	3	0	0	0	32	0	0	0	0	0	35	0
Roma	1	0	1	0	37	43	0	0	0	0	39	43
St. Paul	0	0	0	0	0	0	0	0	14	12	14	12
San Diego [1]	10	0	49	5	4	0	13	2	5	0	81	7
San Francisco [1]	2,592	409	113	14	737	37	140	2	840	149	4,422	611
San Juan	34	24	2	1	48	3	0	0	1	0	85	28
San Pedro [1]	247	0	221	47	153	8	8	1	0	0	629	56
San Ysidro	3	1	0	0	156	7	0	0	0	0	159	8
Savannah	5	0	7	41	0	0	0	0	0	0	12	41
Seattle	245	91	62	36	49	21	35	6	49	6	440	160
Tampa [1]	9	2	8	24	2	2	0	0	0	0	19	28
Washington, D. C.	1,111	1,244	0	0	56	9	0	0	1,137	333	2,304	1,586
Total	15,571	6,167	1,611	3,896	13,471	3,676	1,263	155	3,349	771	35,265	14,665

[1] Collaborators stationed at these ports.
[2] Includes interceptions at Gulfport, Miss.
[3] Includes 63 airplane interceptions made by Public Health Service.

NOTE.—Inspectors stationed at Puerto Rico made 4 interceptions of insects during their field and packing-house inspection of fruits and vegetables for shipment to the mainland.

CERTIFICATION FOR EXPORT

During the year 9,208 certifications covering 4,017,807 containers of plants and plant products were made to meet the sanitary requirements of foreign countries. This represents an increase of 1,799 (24 percent) in the number of certifications and of 1,237,238 (44 percent) in the number of containers certified as compared with 1937.

Export certificates were issued at 33 ports covering 67 different commodities which were exported to 72 foreign countries. Some of the more important commodities certified were: Apples, 3,093 shipments, consisting of 1,906,522 boxes, 60,140 baskets, and 36,947 barrels; pears, 1,012 shipments, consisting of 621,607 boxes; oranges, 584 shipments, consisting of 271,440 boxes; potatoes, 1,328 shipments, consisting of 618,676 bags, 47,637 crates, 19,847 barrels, and 20 boxes.

Many of the shipments of apples and pears were certified under the cooperative arrangement with the Bureau of Agricultural Economics of the Department, whereby licensed inspectors of that Bureau located at shipping points make inspections and issue reports which are accepted by the plant quarantine inspectors at the ports of export as a basis for issuing the required export certificate.

A summary of the export certification work appears in table 23.

TABLE 23.—*Certification for exportation, by ports, fiscal year 1938*

Ports	Certificates issued	Total containers certified	Commodities certified	Foreign countries	Ports	Certificates issued	Total containers certified	Commodities certified	Foreign countries
	Number	*Number*	*Number*	*Number*		*Number*	*Numer*	*Number*	*Number*
Baltimore	120	43,559	2	2	New Orleans	20	2,613	8	8
Boston	2	2	1	2	Newport News	35	742	1	1
Brownsville	4	367	2	2	New York	4,830	1,418,013	35	56
Buffalo	1	40	1	1	Nogales	44	158	5	1
Calexico	85	40,569	7	2	Norfolk	2	27	1	1
Canal Zone	11	13	1	7	Philadelphia	7	18	2	3
Chicago	6	118	3	6	Port Arthur	9	46,443	2	2
Detroit	94	2,689	4	6	Portland	821	504,631	7	13
Douglas	1	20	1	1	San Francisco	408	199,452	16	10
Eagle Pass	1	19	1	1	San Juan	12	13	2	9
El Paso	108	4,312	10	1	San Pedro	462	219,326	5	7
Galveston	9	95	3	4	Savannah	1	29	1	1
Hidalgo	37	1,226	10	1	Seattle	1,974	1,481,265	15	15
Houston	9	44,665	4	3	Tampa	1	1	1	1
Jacksonville	5	3,012	2	4	Washington, D. C.	12	24	2	5
Laredo	10	483	4	1					
Los Angeles	57	3,848	5	5	Total	9,208	4,017,807	------	------
Mayaguez	10	15	2	5					

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REPORT OF THE CHIEF OF THE OFFICE OF EXPERIMENT STATIONS, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., September 1, 1938.

HON. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I transmit herewith a report of the Office of Experiment Stations for the fiscal year ended June 30, 1938.

Sincerely yours,

JAMES T. JARDINE, *Chief.*

CONTENTS

	Page
Introduction	1
Administration of Federal grants to the stations	1
Federal insular stations	2
Hawaii Station	2
Puerto Rico Station	3
Special research fund, Department of Agriculture	4
Regional laboratories	4
Special research projects	7
Cooperation and coordination	7
Publications	9
Experiment Station Record	9
Other publications	9
Manuscripts prepared for publication	10
Library and bibliographic service	10

INTRODUCTION

The administrative and technical advisory functions of the Office of Experiment Stations were again modified and enlarged by provisions of existing legislation and by services occasioned by demands on the State experiment stations and the Department research bureaus growing out of the adjustment and action programs of the Department. The Office continued its usual administrative functions but on an enlarged and intensified scale due to administration of additional research funds made available both to the stations and the Department through title I of the Bankhead-Jones Act of June 29, 1935.

The Chief of the Office continued to serve as Director of Research of the Department with enlarged responsibilities under the Bankhead-Jones Act, section 202 of the Agricultural Adjustment Act of 1938, and other legislation pertaining to the research program of the Department. Discharge of these functions involved assistance of members of the specialist and administrative staff of the Office in service on special committees and boards having bearing on the organization of both Federal and State research and the establishment of effective Federal-State relationships.

ADMINISTRATION OF FEDERAL GRANTS TO THE STATIONS

A major function of the Office is the administration of the expenditures by State experiment stations of the Federal-grant funds provided under the Hatch, Adams, Purnell, title I of the Bankhead-Jones Act of June 29, 1935, and supplementary acts. This involves the critical study, evaluation, and approval of new or revised research projects as proposed by the stations for support from Federal funds, the examination and approval of annual programs of re-

search involving allotments of funds and assignment of personnel, correspondence and conferences with administrative officials and governing boards respecting matters of policy and Federal-State relations, and the detailed examination of the work and expenditures of the stations.

Representatives of the Office visited each of the stations during the year and reviewed the progress and future plans for each project receiving support from Federal funds. The expenditures under these funds were examined in detail for conformity with the provisions of the Federal acts and the objectives of the projects. The work and expenditures of the stations involving State funds submitted as offset to the Bankhead-Jones funds were also reviewed and examined. The visits to the stations also afforded opportunities for supplementing the work of correspondence, office conferences, and regional and national conferences in maintaining and promoting desirable research relationships between States and between State and Federal agencies. The complete project files of the Office are used effectively in the consideration of project proposals and also in the promotion of coordination and the avoidance of duplication. They are being consulted more frequently by Department as well as by State workers than in the past.

The Federal grants to the States, Territories, and Puerto Rico for agricultural research for the fiscal year 1938 amounted to $6,232,500, as compared with $5,620,000 for 1937. Each State received $90,000 under the Hatch, Adams, and Purnell Acts, while Alaska received $22,500, Hawaii $50,000, and Puerto Rico $40,000. The $1,800,000 provided under the Bankhead-Jones Act was allotted on the basis of the respective rural populations of the States, Territories, and Puerto Rico.

The total of funds available from State sources was greatly in excess of the amounts needed to meet the offset requirements of the Bankhead-Jones Act, and no State failed to meet its individual obligations under the act. The total from State sources for 1938 cannot be stated exactly at this time, but is estimated to equal or slightly exceed the $12,074,252 available for 1937, which was an increase of $713,074 over the amount available for 1936.

The grand total available to the stations from all sources, including Federal grants, State appropriations, sales receipts, endowments, special grants, and other supplementary funds, is estimated to be in excess of $18,000,000.

The research programs of the stations financed from all sources included approximately 8,500 research projects embracing a wide range of agricultural and rural-life problems. A total of 2,860 of these projects was supported by the Adams, Purnell, and Bankhead-Jones funds, with supplemental financing in many cases from State funds. Approximately 80 percent of these Federal-fund projects were continued from the previous year and 20 percent were new (439), or revised (119). The total of active Adams projects was 505, of Purnell 1,660, and of Bankhead-Jones 695.

FEDERAL INSULAR STATIONS

The Federal appropriations for agricultural research for use by the Federal stations in Puerto Rico and Hawaii were made to the Office of Experiment Stations, which has direct administrative supervision of the program and expenditures under these funds. The Office also administered the funds for the Hawaii Station originally made available under sugar-processing tax fund allotments and continued available until expended by the Supplemental Appropriation Act, fiscal year 1936 (49 Stat. 1116).

HAWAII STATION

The merging of the Federal and Territorial stations in progress since 1929 was completed at the close of the year. Except for an unexpended balance of approximately $1,494 remaining from the tax-fund allotments, the relationships of the Office to the Territory of Hawaii in agricultural research hereafter will pertain only to the use of the Federal-grant funds. The Federal station was established in 1900 and continued as a separate unit until 1929. Since that time the Federal and Territorial stations have operated under a single director. The lands and buildings of the former Federal station will be used by the Territorial station until other arrangements are made.

The total income of the station during the year was $220,481.32, which included $15,000 Hatch funds, $15,000 Adams funds, $20,000 Purnell funds, and $6,889.80 Bankhead-Jones funds; $79,500 Territorial funds; $2,066 the final direct

Federal appropriation; $79,906 of tax-fund allotments; and $2,119.52 from the Hawaiian Sugar Planters' Association for rodent-control work. The tax-fund allotments were used for the continued support of seven projects dealing with taro investigations, liver fluke eradication, rat abatement, development of truck farming and improvement of marketing facilities, development of livestock feeds, development of tropical fruits and nuts, and promotion of the poultry industry.

A tract of 30 acres, known as Poamoho Farm and located beyond Schofield Barracks, 22 miles from Honolulu, was made available by the Territory of Hawaii on September 1, 1937, for use as a substation. An irrigation system was partially installed, and the area was largely planted to fruit trees and experimental grasses.

Definite advances in research were made. The drug Distol, containing asphidinolfilicic acid, hexachlorethane, and talc, has proved highly effective in destroying flukes in cattle without injury to the animal when proper dosages are used. Work with papayas, macadamia nuts, potatoes, sweet corn, and tomatoes has greatly aided producers of these crops. Digestion coefficients of local feeds and grasses have been determined, and the greater economy in livestock feeding through the better use of local feeds and byproducts has been shown. Rodent-control work was done in cooperation with the Bureau of Biological Survey, and chemical studies of the papaya were in cooperation with the Bureau of Chemistry and Soils. Cooperation was also extended to the Soil Conservation Service in the making of a preliminary soil-erosion survey.

PUERTO RICO STATION

The Federal station at Mayaguez increased its service as an outpost of the Department in the Tropics and also made important contributions to the improvement of agriculture in the island. While the Federal station and the Insular station at Rio Piedras have intermediate problems of joint responsibility requiring complementary activities, the primary function of the Federal station is to serve the national interests and responsibility in agricultural investigations in the Tropics, and that of the Insular station to solve local agricultural and rural-life problems. Since each in serving its major function may serve the function of the other, they will always be linked in scope and function.

In serving its primary function the Federal station carried on a considerable part of its work in cooperation with other agencies of the Department, especially the Bureaus of Entomology and Plant Quarantine, Plant Industry, and Chemistry and Soils. The work of the Forest Service and the Soil Conservation Service was also housed at the station. Of the cooperative work conducted during the year the following yielded or gave promise of outstanding results:

In cooperation with the Bureau of Plant Industry, a clearer understanding was obtained of the environmental conditions essential for the growth of quinine plants. One particular planting has developed successfully, although other sites have been unfavorable. Because sweetpotatoes flower and set seed readily in Puerto Rico, and but rarely in the continental United States, the breeding program of the Department has been measurably advanced by 3,000 controlled crosses and self-pollinations with 13 continental varieties made in 1938. Seed from these, together with a large quantity of open-pollinated seed of Puerto Rican varieties, was obtained. A study of data indicate that the island could also serve to advantage as a winter breeding station for certain other vegetable and field crops by way of supplementing and accelerating the breeding programs of the Department and State experiment stations.

The cooperative work with the Bureau of Entomology and Plant Quarantine has involved the introduction and successful colonization of insect predators and parasites which attack scale insects and the mealybug of pineapple. Particularly outstanding was the successful introduction and multiplication of the Amazon fly, a parasite of the moth borer of sugarcane and corn. Some degree of successful colonization has already been indicated. The studies of rotenone-yielding plants, which are also cooperative with the Bureau of Plant Industry, indicate that rotenone content may be influenced by agronomic practices as well as the inherent capacity of individual plants.

A considerable improvement in methods of processing vanilla beans for the production of vanilla has been made in cooperation with the Bureau of Chemistry and Soils. Satisfactory methods for germinating the seed have been developed.

Other work designed especially for local benefit included the development of new uses for bamboo; the experimental propagation of spice crops, including

ginger, nutmeg, and cinnamon; successful trials in the canning of mangoes; and new developments in the extraction and utilization of the essential oils of lemon grass, ylang ylang, and ambrette. Several interesting perfumes were blended from these essential oils.

SPECIAL RESEARCH FUND, DEPARTMENT OF AGRICULTURE

The Office of Experiment Stations continued to administer the special research fund, Department of Agriculture, authorized by title I, section 4, of the Bankhead-Jones Act, approved June 29, 1935. Of the sum of $1,200,000 available during the year, 50 percent was for the establishment and maintenance of research laboratories and facilities in the major agricultural regions and for the maintenance of research at such laboratories, 48 percent for special research projects of the Department, and 2 percent for administration of the allotments for research to Puerto Rico and the States and Territories authorized by the Bankhead-Jones Act.

REGIONAL LABORATORIES

The laboratories established in 1936 and 1937 in major agricultural regions began to function in cooperation with the State experiment stations as important centers of research in their particular fields of inquiry. The considerable degree of success they seem to have attained in the brief space of a year or two may be attributed in part to the procedure followed in planning their organization and programs of research. The final determination of plan of work and location, which is the responsibility of the Secretary, followed in all instances joint recommendations of the station directors of the regions to be served and representatives of the Department. Before outlining the fields of investigation and the details of specific projects for study in a region, a conference of representatives of the experiment stations and of the bureau or bureaus of the Department having subject-matter responsibility made a thorough review of the pertinent research accomplished or in progress. The plan of work as finally approved was designed to supplement and integrate the work of the States and the Department, especially in the basic or fundamental aspects of the problem as applied to the region as a whole. In some particulars many of these studies will serve national as well as regional and local needs. Provision has been made for the continued cooperation of the stations and the Department in regional research with the laboratories as focal points by the appointment of a representative of each cooperating agency to serve as a collaborator. The group of collaborators meets from time to time, reviews the work in progress, and plans new lines of attack.

The Office of Experiment Stations has served as a coordinating agency in the establishment and operation of the regional laboratories and has exercised an over-all administrative function by virtue of its responsibility for administering the special research fund. Eight regional laboratories have been established to date, three in 1936, three in 1937, and two during the fiscal year 1938.

PROGRESS OF LABORATORIES PREVIOUSLY ESTABLISHED

The vegetable-breeding laboratory, established in 1935, near Charleston, S. C., in cooperation with 13 Southeastern States, had assembled its staff and completed the physical plant and equipment by the close of the fiscal year 1937 and was able to give full attention to the research program in 1938. In line with the object of developing improved varieties of vegetables for the southeast region of the United States, major attention was given to the breeding of snap beans, cabbage and other crucifers, watermelons, tomatoes, and sweet corn. A wide range of plant materials of these and other crops having a possible value in the region were tested for quality, disease resistance, and adaptability to soils and climate. Pure lines for breeding purposes were established by inbreeding, and inbred lines from crosses were tested for adaptation. Promising leads were obtained in the search for tolerance or resistance to powdery mildew, rusts, and common and halo blight of beans; cabbage yellows; watermelon anthracnose; wilt, fruit crack, and leaf- and fruit-spotting diseases of tomatoes; and to earworm damage in sweet corn; also in the isolation of strains having the desired quality, market type, cold resistance, and seasonal adaptability. Special breeding techniques applicable to the region are being developed.

The pasture research laboratory for the northeast region, established in cooperation with the experiment stations of 12 States at State College, Pa., in 1936, having completed the physical plant and assembled the staff, gave considerable attention to perfecting the details of the research program and to the promotion of cooperative research throughout the region. Some 30,000 individual plants of the chief pasture species prevalent in the Northeast were established in nursery plantings in 1937, having been obtained in pastures throughout the region and from other sources. Wide variations in habit and type of growth occur within the species as obtained from such sources. Variations in chemical composition, disease resistance, and nutritional requirements are also evident. The genetic and cytologic basis for these variations is being explored as a necessary background for the breeding for improvement which is to follow. Other studies recently begun deal with the chemical composition of pasture plants as affected by environment and management practices, and the nutritional requirements of varieties and strains.

Work at the regional soybean industrial-products laboratory, established in 1936 at Urbana, Ill., in cooperation with 12 experiment stations of the North Central States, has led to results of interest and value. The development of all-soybean-oil varnishes has created a great deal of interest in the trade. These varnishes give films of good weather, water, acid, and alkali resistance under practical test conditions. The better utilization of soybean meal is the objective of studies dealing with the physical and chemical properties of the proteins and their dispersion in various solutions. Important progress has been made in the development of plastic materials from soybean proteins. Considerable experimental work has been completed on factors governing the quality and quantity of oil and meal produced in expeller-pressing operations. The Bureau of Chemistry and Soils has responsibility for six projects dealing with chemical investigations, while the Bureau of Plant Industry directs the work of three projects concerned with the composition of varieties of soybeans when grown under the variations in environment found in the area, and the development by breeding and selection of improved varieties and strains for industrial uses. Significant variation in chemical analysis of seed was found among the 10 varieties and 5 locations and between the 2 years involved in the agronomic tests. Valuable relationships were observed regarding the inheritance of factors governing composition of soybeans and quality of oil.

In many respects the regional laboratory for the improvement of swine through breeding, established at Ames, Iowa, in 1937, will serve national interests as well as those of the 13 cooperating States of the north-central region. The research program deals with fundamental problems designed to perfect systems of breeding for the more efficient performance of breeds that are standard throughout the United States, as well as recent introductions that may have a place in American agriculture. The necessary facilities of physical plant and equipment were completed or under construction during the year, and the staff was assembled. Foundation herds were established, and breeding work was initiated at the Iowa, Minnesota, Missouri, Nebraska, and Oklahoma stations, which are cooperating actively in the regional program. Experimental litters were on hand at all cooperating stations at the close of the year. Stock was accumulated to start 12 inbred lines of the Poland China and 7 of the Duroc-Jersey breeds. These inbred lines will permit the testing of the breeding merit of inbred boars both within a breed and in crosses between two or more strains, types, and breeds. Records are being obtained which will serve as a basis for analyzing the modes of inheritance of the various characters, especially those of economic importance. Cross-breeding involving the Danish Landrace and the Tamworth breeds is also under way.

At the western laboratory for the improvement of sheep through breeding, established at Dubois, Idaho, in 1937, with the object of developing for western ranges sheep superior for hardiness, yield and quality of wool, and lambs produced, the main laboratory building was completed and other facilities were partly completed. The new laboratory takes advantage of work already established by the Department under regular funds and the program is organized in cooperation with 12 States of the western region. The studies now being developed include inbreeding and cross-breeding, the selection of proved sires for the isolation of strains of superior merit, basic studies of the physiology of reproduction, and studies of wool fibers. Inbreeding in the Rambouillet breed was begun with 20 rams representing as many different lines of breeding as could be obtained. Each of these was mated with 25 ewes. The testing of young sires for heading new inbred lines was also under way with 12 pens consisting of 1

ram and 20 ewes each. Differences in sperm characters were observed but these could not be correlated definitely with breeding results.

The completion of buildings and the equipment of laboratories were accomplished at the regional laboratory established at Auburn, Ala., in 1937, for the study of contagious, infectious, and parasitic diseases of domestic animals and poultry. The director and the professional staff were appointed and reported for duty, and the program of research had gotten under way by the close of the current year. The 13 State stations of the southeast region cooperated with representatives of the Bureau of Animal Industry in developing the plan of work. The problems under study are of particular importance in the South where the production of livestock and poultry is favored by the climate and environment but where many factors operate that favor the spread of diseases and parasites. They deal with fundamental principles of infection, resistance and immunity, and the development of effective control measures for the contagious, infectious, and parasitic diseases of domestic animals and poultry. Current research is focused on chronic bacterial dysentery (Johne's disease) of cattle, and gastrointestinal parasites of domestic animals and poultry.

NEW LABORATORIES

Organization work incident to the establishment and functioning of two additional regional research laboratories was undertaken during the year.

The serious losses to the poultry industry from diseases, especially fowl paralysis, for which effective remedial measures are lacking, led to a conference in December at which representatives of the experiment stations of 13 North Central and 12 Northeast States and of the Bureau of Animal Industry and the Office of Experiment Stations of the Department outlined a research program as a basis for establishing a laboratory to improve the viability of poultry to serve the two regions. The proposal was approved December 23, 1937, and a tract of 50 acres deeded to the Government by Michigan State College was later designated as the site for the laboratory. The location is 1 mile south of the college campus at East Lansing, Mich. Plans for the central laboratory building and for brooder houses and smaller buildings for special disease studies were completed, and it is expected that construction will proceed so that the buildings may be occupied by January 1, 1939. Early in its research program the laboratory will concentrate on a search for the particular causative agent or agents responsible for fowl paralysis and will attempt to determine to what extent breeding for resistance to this disease can be successful. Related projects dealing with the effects of different management practices, nutrition practices, and parasitism on the incidence of disease will be undertaken as rapidly as possible.

The problem of loss of productivity of irrigated land caused by the accumulation of soluble salts or "alkali" is to receive thorough study in the eighth regional-laboratory program established under the Bankhead-Jones Act. The salinity problem is an important one on about half of the 20,000,000 acres now farmed under irrigation, likewise on other large areas of land suitable for irrigation which cannot be used for cropping until some method of removing the alkali is devised. In formulating a program for meeting this problem the directors of 11 Western State stations and Hawaii met with representatives of the Department in Washington, D. C., in November and again in Salt Lake City, Utah, in December. The latter conference, which also included technical workers in the field of irrigation agriculture, outlined a cooperative plan of work and a memorandum of agreement to embrace the work of the stations comprising the region as well as that of the laboratory proper. The conference also recommended the Rubidoux Laboratory of the University of California at Riverside, Calif., as a desirable site for the headquarters of the regional program. The recommendations of the conference were approved by the Secretary December 23, 1937, and since then rapid progress has been made in perfecting facilities and organization. The Rubidoux Laboratory with 2½ acres of land has been made available to the Department by the University of California on a long-term lease and 10 additional acres adjoining this property are being purchased. Two research greenhouses are now under construction, and some absorption and percolation studies have been started. It is anticipated that the program will be in full operation about January 1939. A director and the collaborators who represent the stations were appointed before the close of the year, and this group, together with representatives of the Bureaus of Plant Industry and

Agricultural Engineering, will meet at least once each year to review the work and plan the next steps in the program. One phase of the research program will deal with scientifically controlled growth studies to measure the effects on specific crop plants of various salt solutions typical of the irrigation waters of the area.

SPECIAL RESEARCH PROJECTS

New lines of investigation on problems having national scope and application have been undertaken through allotments of the special research fund authorized for the use of the Department by title I of the Bankhead-Jones Act. During the 3 years for which these funds have been available, a total of 56 projects have been initiated and 17 have been completed or discontinued. The latter included a considerable range of subject matter in which such subjects as the actuarial basis for "all-risk" crop insurance, the factors affecting fertility in certain crop plants, and the changing balance between agriculture and industry may be cited as examples. Of the completed projects, seven were active for 1 year, eight for 2 years, and two for 3 years. The 44 projects which were active in 1938 involved research workers in 11 bureaus of the Department and the cooperative services of many of the State experiment stations. The results of these investigations are reported by the bureau or bureaus having immediate direction of the work.

COOPERATION AND COORDINATION

Substantial progress in expanding and strengthening cooperative-coordinated attack in research by the Department and the State agricultural experiment stations is reflected in the fact that during the year the Office examined, approved, and recorded over 1,350 new or revised formal agreements covering cooperative research between bureaus of the Department and the stations. These again covered nearly 1,000 major research undertakings in which all of the State experiment stations and all but one of the research bureaus of the Department participated. This program of formal cooperation in research represented a substantial increase over the previous year. In addition, there was again much informal cooperation between organized regional and national groups of stations and in some cases between such groups and the Department. Some of these were of major importance in that they were forerunners of formal cooperative research affecting specialized phases of agricultural production and rural life involved in the action and adjustment programs.

The State experiment stations were working more closely and effectively than ever before with other State agencies and local organized groups, with each other in regional groups, and with the Department individually and in regional and national groups in efforts to plan and coordinate their attack on important agricultural problems, particularly those affected by the action and adjustment programs. In certain regional and national cooperative studies, which began on an emergency basis as recovery measures during the earlier depression years, an analysis was made of the achievements of previous years and the studies were focused on the practical aspects of a permanent economically adjusted agriculture. Certain phases of the national study of adjustments in farming by regions and type-of-farming areas were continued in 35 States with the cooperation of the Agricultural Adjustment Administration, the Bureau of Agricultural Economics, the Forest Service, the Farm Security Administration, and the Soil Conservation Service. Similar work was completed in the 13 other States. This national synthesis of available agricultural information made notable progress toward filling in the gaps in the knowledge of agriculture and rural life essential to rational and effective agricultural conservation and adjustment. The procedure was modified and focused on selected sample counties in the cooperating States with a view to perfecting local agricultural-adjustment techniques.

For each of the two new regional laboratories established during the year under provisions of title I of the Bankhead-Jones Act of June 29, 1935, and discussed elsewhere in this report, the memoranda of understanding entered into by the Department and the experiment stations concerned provided for integration of research at the laboratory with research at the experiment stations in the region, and for the joint annual review and revision of the research program. The memorandum of understanding covering the laboratory for improvement of viability in poultry, for example, provides for coordination of the plans and work on this subject at 25 experiment stations in the north-central and northeastern regions with those of the Department.

Typical of the cooperative research into broad regional or national problems, initiated under the provision of the Bankhead-Jones Act for research by the Department other than at regional laboratories, was the investigation of possibilities of long-range weather and crop forecasting, including a study of the relation of weather to crop yields. This investigation, which has been in progress more than 2 years, involves the work of six Department bureaus, five State experiment stations, and one land-grant college, together with other organized State groups.

Federal and State agencies completed the national cooperative survey of research in soil science and related problems. This provided part of the material on soil science published in the Yearbook of Agriculture for 1938. The survey involved all the Department bureaus concerned with soils, soil science and land use, and all of the State experiment stations.

Coordination of research on cotton diseases, in which 12 State experiment stations are cooperating with the Bureau of Plant Industry, was expanded and strengthened.

The cooperative efforts at crop improvement and in the development of production methods along cost-saving lines were continued and expanded. The cereal-crop-improvement investigations were extended to include 21 States and the investigations of machinery for the mechanical application of fertilizers to cotton, potatoes, sugar beets, and canning crops and for the production and harvesting of sugar beets and corn, involved 18 stations, of which 7 completed their work.

Another example of cooperative research was the western range survey, which covered 7 distinct regions and involved 17 western stations, 4 Department bureaus, and the Department of the Interior. The cooperative soil survey was extended to 29 States, and the cooperative study on the breeding and culture of potatoes was extended to 17 States. Other similar cooperative researches were the study of farm population and farm-population movements involving 12 State experiment stations, fertilizer and forage-crop investigations, studies of the conformation and anatomy of the dairy cow, studies of cereal- and forage-crop insects, and studies of the quality and palatability of meat, each involving 11 stations. The meat investigations, which have been actively pursued for 12 years by the Department in cooperation with 20 or more State stations, were reviewed to establish progress and determine the character and scope of future studies.

The over-all memorandum of understanding covering research relationships between the Soil Conservation Service and the State experiment stations became effective with 47 stations, and active research-project agreements covering definite lines of soil-conservation research were entered into with 36 stations. For example, the study to determine the economic and social effects on farms resulting from the operation of a definitely planned program of soil conservation involved 17 State stations and the Bureau of Agricultural Economics in addition to the Soil Conservation Service. Hillculture studies were cooperative with five stations and an exploratory study of soil erosion was begun during the year in cooperation with each of the six New England States. Nineteen State stations and four Department bureaus were cooperating in studies of various factors affecting soil and water conservation. A new and useful feature of the soil-conservation research is the informal interstate cooperation resulting from the establishment of soil-conservation areas in locations that involve and serve the interests of several States.

Coordination along regional lines of research on nutritional problems was strengthened by progress in projects already under way dealing with certain phases of the nutritional wellbeing of young women of college age. The comprehensive program of cooperative research in six stations of the North Central States on the nutritional status of college women entered the third year of the 5-year plan with a satisfactory accumulation of useful information. Plans for the publication of papers on techniques developed during the course of the investigation were made at the yearly conference of the project leaders, and for the organization and analysis of data on about 800 anthropometric measurements.

The study on vitamin C, in progress under formal memorandum of understanding in six of the State experiment stations of the Northwest and in several Northeastern States, afforded opportunity for comparisons among the participating States and between the groups in the Northeast and Northwest.

Plans for a cooperative study of variations in composition of vegetable foods grown in different areas of the South were formulated at a conference of

directors, chemists, horticulturists, and home economists from several experiment stations of the Southern States with representatives of the regional vegetable-breeding laboratory. A planning committee representing the three research fields has drawn up detailed procedures for a study in which six southern stations have already agreed to participate.

In numerous other regional and national studies of a long-time character the Department cooperated with various groups of experiment stations. The total number of formal agreements covering cooperative research ranged from 6 to 58 per station.

PUBLICATIONS

The publications of the year included the usual abstracts of the research literature of agricultural science and home economics; reports of research accomplished at the experiment stations, their organization, finances, and personnel; bibliographies of station publications and of research in special fields; reports and bulletins of the Puerto Rico Federal Station and the Hawaii Station; and articles dealing with such other material as was considered essential to the proper administration of the Federal acts and the conduct of other functions of the Office.

EXPERIMENT STATION RECORD

In accordance with the provision in the Hatch Act authorizing the Department to provide, for the State experiment stations, "such advice and assistance as will best promote the purpose of this act," the publication of Experiment Station Record was continued. The Record made its usual monthly appearance promptly throughout the year, together with the regular volume indexes and a combined index covering volumes 61 to 70. Volumes 77 and 78 were completed, presenting in addition to the monthly editorials and news notes 3,551 and 3,667 abstracts, respectively, of the current literature in agricultural science and home economics. This was an increase over the previous year of 374 abstracts, although the total space available remained at the maximum limit of 1,800 printed pages as established in 1911.

Toward the close of the year a serious shortage in the printing allotment developed as a result of a readjustment of charges by the Government Printing Office. The immediate emergency was met by the omission of volume 79, No. 2 (August 1938), the issue intended for July being published in the usual size as volume 79, No. 1–2 (July–August 1938). It is expected that such further curtailments as may be necessary will take the form of abridgments of the individual monthly issues.

For many years the problem of adequately covering the literature in the space available has been becoming more and more difficult. Increasingly drastic selection of material for review and the introduction of a number of minor economies in style and mechanical set-up of abstracts have retarded only slightly the congestion resulting from the increase in the literature to be expected from the steady expansion of research agencies. Under these circumstances the curtailment of space already resulting from and foreshadowed by the increase in printing rates, estimated at from 10 to 20 percent, has acutely intensified an already grave situation.

OTHER PUBLICATIONS

The following articles and Department publications written by workers in the Office or under its supervision were issued during the fiscal year:

Report of the Chief of the Office of Experiment Stations, 1937, by James T. Jardine.

Report on the Agricultural Experiment Stations, 1936, by J. T. Jardine, W. H. Beal, et al.

List of Bulletins of the Agricultural Experiment Stations for the Calendar Years 1935 and 1936, by Catherine E. Pennington. U. S. Dept. Agr. Misc. Pub. 294.

Workers in Subjects Pertaining to Agriculture in Land-Grant Colleges and Experiment Stations, 1937–38, by Mary A. Agnew. U. S. Dept. Agr. Misc. Pub. 299.

Production and Marketing of Truck Crops in the Territory of Hawaii, by O. C. Magistad and T. O. Frazier. Hawaii Agr. Expt. Sta. Bull. 78 (published in Hawaii).

Method of Evaluating the Macadamia Nut for Commercial Use and the Variation Occurring Among Seedling Plantings in Hawaii, by J. C. Ripperton, R. H. Moltzau, and D. W. Edwards. Hawaii Agr. Expt. Sta. Bull. 79.

Report of the Hawaii Agricultural Experiment Station, 1937 (published in Hawaii).

Report of the Puerto Rico Experiment Station, 1936.

Foods, Human Nutrition, and Problems Related to the Home, by Sybil L. Smith. Separate from Rept. on the Agr. Expt. Stas., 1936.

Possibilities of Cooperation Between the United States Department of Agriculture and the States in Summary Publications,

by J. T. Jardine. Proc. Fifty-first Ann. Conv. Assoc. Land-Grant Colls. and Univs. 1937: 163–165. [1938.] [Also mimeographed.]

The Policies and Procedure Involved in the Hatch Act from the Standpoint of Efficiency in Administering Productive Research, by R. W. Trullinger. Proc. Fifty-first Ann. Conv. Assoc. Land-Grant Colls. and Univs. 1937: 144–147. [1938.] [Also mimeographed.]

Research in Home Economics at the Land-Grant Institutions, 1937–1938. Compiled by Sybil L. Smith and Mabel A. Dickson. 27 pp. 1937. [Mimeographed.]

List of Station Publications Received by the Office of Experiment Stations, July 1937–June 1938. 3–5 pp. ea. [Mimeographed.]

A Third Shelf of Home Economics Research, by Sybil L. Smith. Jour. Home Econ. 30: 99–100. 1938.

Additions to Bibliography on Standardization of Field Experiments, by H. M. Steece [et al.]. Jour. Amer. Soc. Agron. 29: 1042–1045. 1937.

Agricultural Engineering Digest. A review of current literature by R. W. Trullinger, contributed monthly to Agricultural Engineering.

MANUSCRIPTS PREPARED FOR PUBLICATION

At the close of the year publications in press included two numbers of Experiment Station Record; Report on the Agricultural Experiment Stations, 1937; and Report of the Puerto Rico Experiment Station, 1936 (Spanish edition).

The following manuscripts were prepared and submitted for printing during the year: Puerto Rico Station Circular 22, An Annotated Check-list of the Parasites of Animals in Puerto Rico, by H. L. Van Volkenberg; and Report of the Puerto Rico Experiment Station, 1937.

In addition, manuscripts were reviewed for publication in Hawaii, as follows: Grasses of Hawaiian Ranges, by L. D. Whitney, E. Y. Hosaka, and J. C. Ripperton; Observations on the Life History of *Fasciola gigantica*, the Common Liver Fluke of Cattle in Hawaii, and of the Intermediate Host, *Fossaria ollula*, by J. E. Alicata; and Nursery Propagation and Topworking of the Macadamia Tree, by J. H. Beaumont and R. H. Moltzau.

LIBRARY AND BIBLIOGRAPHIC SERVICE

The library of the Office, in cooperation with the Department Library and Extension Service, maintained as in previous years its files of the publications of the stations, the United States Department of Agriculture, and the extension services of the State colleges.

The 3,088 publications of the stations and the Department of Agriculture current for the year were collected and prepared for the use of the Office staff and assignment to the specialists for abstracting in Experiment Station Record. From the publications received by the Department Library 2,647 books and 30,636 periodicals were selected for circulation in the Office of Experiment Stations and the Extension Service. Many of these were examined for experimental and research data and submitted to the Record staff for review.

The eighth supplement to Department Bulletin 1199, a list of station bulletins published in 1935–36, was issued with a total distribution of 3,961 copies, 961 copies being sent to libraries and individuals of the land-grant colleges and 3,000 copies in response to individual requests. Work on the index to the station bulletins published prior to 1923 was continued with the thought of making available a complete indexed list of the bulletins issued from the organization of the stations through 1930, for which there is increasing demand.

Lists of contributions by station workers appearing in current scientific journals were compiled and published monthly in Agricultural Library Notes, as were also the monthly lists of the State extension publications. From 100 periodicals examined, 3,325 titles by station workers were listed, including 67 from the Journal of Agricultural Research contributed by 27 stations. Lists of current station publications were compiled monthly and distributed in mimeograph form to agricultural colleges, stations, libraries, other institutions, and to individuals having interest in station work. The files of station publications were consulted by workers throughout the Department, particularly those in the newer agencies. Biographical data and short lists on specific subjects were compiled, and publications were supplied in answer to requests. Other work accomplished included the preparation and filing of 17,831 index cards in all catalogs in the library and the binding of 676 volumes of station and Department publications for the Office and for the Hawaii and Puerto Rico Stations. In addition to the permanent binding, 440 volumes were placed in temporary binders.

U. S. GOVERNMENT PRINTING OFFICE: 1938

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FOR BETTER RURAL LIVING

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A REPORT *of Cooperative Extension Work in Agriculture and Home Economics in 1938*

EXTENSION SERVICE • WASHINGTON, D. C.

UNITED STATES DEPARTMENT OF AGRICULTURE

FOR BETTER RURAL LIVING

A REPORT *of Cooperative Extension Work in Agriculture and Home Economics in 1938*

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UNITED STATES DEPARTMENT OF AGRICULTURE

ISSUED MARCH 1940

FOREWORD

1938 marks a quarter century of cooperative agricultural extension work by the Federal, State, and county governments through joint employment of trained county agricultural and home demonstration agents. Such agents are now employed in every county of agricultural importance in the country.

In 1¼ million meetings, 3,000,000 farm visits, 22,000,000 office calls from farm people, and nearly 1,000,000 adult result demonstrations, county extension agents in 1938 continued to spread and interpret the latest scientific and economic information about better farming and homemaking.

With the help of 143,000 voluntary local leaders, the agents are reaching 40 percent of the rural boys and girls of the country in 4–H Club work, inspiring and training them in farming and homemaking and good citizenship.

Close cooperation with other agencies of the Government allowed extension agents to strengthen their efforts in assisting farm people in soil conservation and better-balanced farming and in pushing stronger programs for underprivileged farm families. The agents during the year assumed local leadership in a vast national program of land-use planning by farm people with assistance from the agencies of Government in position to help carry out the plans.

The agents helped farm people recover from a devastating hurricane in New England, helped them save their crops from grasshoppers in the Middle West and from chinch bugs in the wheatfields, helped Southern farmers fight screwworms and other livestock pests, and helped countless farmers and gardeners save their fruits and vegetables from insects and diseases.

Improved varieties of crops, a more adequate home food supply, healthier, more nutritious meals, savings on clothing the family, and organizing and assisting farmer cooperative marketing associations, are among the results of the work of extension agents, assisted by a small corps of State and Federal extension specialists. These, as well as results of other education work, are hard to measure, but they are vital to rural living and to the general welfare.

C. W. Warburton,
Director of Extension Work.

CONTENTS

	Page
Foreword	II
Extension moves into broader fields	1
New problems bring new methods	2
Considers farm and home as a unit	2
Trains half a million local leaders	2
Helps more than 5,500,000 families	3
Explains national programs	3
Organizes for land use planning	4
2,200 local planning committees	4
Marketing service helps more than a million farmers	5
Farm-management program offers many services	6
Interprets outlook data	6
Agents help farmers use credit wisely	7
Gives technical advice on crop production	7
Better varieties widely grown	8
One-variety cotton campaign moves ahead	8
Fights insect pests and other parasites	8
Aids in forage and pasture improvement	9
Offers engineering service to farmers	9
Extension helps in farm forestry	10
Flock and herd improvement makes progress	10
Dairy program centers on herd improvement	11
Poultry improvement reported	12
Cold-storage lockers meet important need	12
Better living is aim of home demonstration program	13
Planning before action	13
Foods program calls for adequate diet	13
Home-management program offers practical help	14
Better ways to use clothing money	15
More interest in parent-education program	15
Community betterment fostered	15
Serving the Nation's youth	15
More interest in music and radio	16
Club camps popular	16
143,017 volunteer leaders at work	17
Clothing project still the most popular	17
Better food-handling methods	17
Crop and livestock projects in club program	17
Club members practice conservation	18
Program for older youth	18
Negro agents at work in 16 States	19
Gardens for health	19
Progress in home improvement	19
Telling the story of agriculture	20
Bulletins answer many requests	20
Photographs and other visual aids	20
Department exhibits shown in 34 States	21
Millions see Department motion pictures	21
Agents study to keep informed	21
Studies point way to more effective extension work	22
Funds and personnel	22
Extension loses leaders	23
Statistics	25
Results, 1938	25
Funds, 1938	37

For Better Rural Living

A Report of Cooperative Extension Work in Agriculture and Home Economics in 1938

Prepared by the Extension Service. C. W. Warburton, Director, Reuben Brigham, Assistant Director

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Extension Moves Into Broader Fields

The cooperative agricultural Extension Service, an educational movement combining the resources of Nation, State, county, and community, reached new levels of service to rural America in 1938, the twenty-fourth year of its existence as a Nation-wide organization.

Extension agents were called upon more than ever before to furnish technical information and to help develop leadership to meet the individual and group problems confronting farm people. More than 5½ million families received information or assistance from the extension staff during the year, an increase of more than half a million over the number assisted in 1937.

In addition to meeting this continuous demand for practical scientific facts that could be put to work on farms and in homes, the Extension Service continued to move into broader fields of planning and action affecting agriculture and homemaking.

To the established task of teacher and demonstrator, extension agents in recent years have added two other major endeavors. One is explaining the various action farm programs of the Government and guiding farm people to make the greatest use of them. The other is assisting farm people themselves to develop sound land-use and adjustment programs on a community, county, State, and national basis.

County extension agents are established in their counties as friends in whom the farm people have, from years of service, developed confidence. The job of the agents is, first, to encourage and help farm people to do all they can as individuals to solve their own problems; second, to encourage voluntary cooperation with other farmers on a community and county basis; and third, to encourage cooperation with other farmers and groups and with their State and Federal Government on a State and National basis.

New Problems Bring New Methods

In the early years of extension work the emphasis was on the individual enterprise, even on the individual operation. County agents themselves culled hens, tested soil, and grafted apple trees to show individual farmers, or small groups of farmers, how to perform these specific operations. It was a period of establishing confidence through demonstrations, mostly demonstrations based on proved biologic fact, requiring only intelligent participation to prove profitable to the farmer.

These demonstrations did establish confidence in the county agent and the institutions he represents. That confidence has been maintained, and demonstrations supervised by the county agent remain one of the most convincing of all extension teaching methods.

New days brought new problems and new methods. The county agent was in the front lines of the "food will win the war" campaign of 20 years ago. Then came a decade of widespread agricultural depression. More recently he found himself confronted with new responsibilities as interpreter of Federal programs designed to help adjust agriculture to new conditions. Now he has been given broad responsibility in his county in organizing and helping farm people plan their own programs; local programs then can be brought together into State and national coordinated programs.

Considers Farm and Home as a Unit

Accompanying the quickening interest in community and county study of agricultural problems and adjustments, 1938 saw further development of the whole farm-and-home approach in considering all the problems of the farm family as a unit.

Whole farm-unit demonstrations, for example, are supplementing and to some extent replacing the single-enterprise demonstrations extension agents have been using to introduce improved practices.

More and more the farmer, the farm wife, the farm boy and girl were seen in joint conferences with the county agent, the home demonstration agent, and extension specialists from the State college to plan a whole-farm approach program for solving their problems and improving their situation.

Trains Half a Million Local Leaders

The county agent learned long ago that he could not meet the ever-increasing demands for his services without organization and assistance. So he, and later the home demonstration agent and club agent, set about training local people with leadership ability to take improved farm and home methods to their communities, thereby

greatly increasing the scope of extension as a teaching agency. By 1938 a total of 586,544 voluntary local leaders were being trained, becoming invaluable assistants to the 6,507 county extension agents and enabling them to serve more farm people.

Helps More Than 5,500,000 Families

To say that 4,635,000 farm families were influenced by some part of the extension program in 1938 is impressive. But the tremendous scope of the Extension Service, serving as it does every county of agricultural importance, is even more apparent when we realize that this number is approximately two-thirds of all farm families in the country. And in addition, 891,000 families not on farms participated in some way in the extension program, many of them in some project relating to homemaking.

More than 1,286,000 rural boys and girls of the Nation are members of 4–H Clubs, and the half million new members each year represent not far from 40 percent of all the rural boys and girls in the country that annually reach 4–H Club average starting age of about 12 years.

More than 1,000,000 women belonged to homemakers' clubs and other groups organized to carry on home demonstration work. In 1,914,000 homes some changes and improvements were made because of the home demonstration program.

County extension agents held more than 100,000 leader-training meetings with a total attendance of 2,087,518 men and women, who, in turn, were better prepared to pass along information to their neighbors.

Some idea of the activity centering in extension offices may be gained from the record of office calls relating to extension work as reported in 1938. These personal calls reached the record high total of 22,123,152—approximately 25 a day in each county office. As recently as 1933, the number of office calls reported was only a little more than 8,000,000, an increase of more than 175 percent in 5 years. County extension agents in 1938 made 2,973,000 farm and home visits, and held 1,278,000 meetings.

Explains National Programs

Extension agents carried a large part of the responsibility for explaining the 1938 agricultural conservation program to farm people. At the same time they tried to help individual farmers make the best possible use of the advantages made available by the program. More than ever the tendency was to transfer administration of the program to farmers themselves.

For example, extension workers in all sections of the country provided subject-matter helps and special training for Farm Security

Administration supervisors and their clients. They did educational work in connection with organization of soil conservation districts through which the Soil Conservation Service and other agencies help farmers control erosion. Extension agents also worked shoulder to shoulder with the Rural Electrification Administration, Tennessee Valley Authority, Farm Credit Administration, and many other agencies in trying to help the farm people in their sections meet their needs.

Organizes for Land Use Planning

One of the most significant developments of the year in relation to the Extension Service was the adoption of a working agreement between representatives of the land-grant colleges and the United States Department of Agriculture on a far-reaching program of land use planning.

Committees representing the colleges and the Department met at Mount Weather, Va., in July 1938, to act on recommendations made after almost 2 years of investigation into the general subject of relations between the colleges, the Department, and the new Federal agencies created to serve agriculture.

At that time it was recognized that there was a need for land use planning, beginning with farmers themselves as a basis for agricultural programs, and a joint statement was prepared by the committees, outlining general methods recommended for the development of such a program in all States.

The Extension Service was assigned the responsibility for organizing the community, county, and State committees and forwarding this broad program of land use planning. State extension directors were authorized to bring together representatives of interested agencies of the Department in their States to work out the most practical methods of putting the plan into operation. At the same time county agents were asked to assume similar responsibility in their counties.

The plan calls for establishment in each agricultural county of a land use planning committee, with the county agent usually serving as nonvoting secretary. Membership of this committee is made up principally of farm people with appropriate representation from other Federal and State agencies concerned with administration of land use programs. Provision was also made for creation of a State land use planning committee composed of farm men and women and State administrators of Government agencies concerned with land use.

2,200 Local Planning Committees

By the end of 1938 field work with local committees was under way in most States. Approximately 2,200, or three-fourths of the agricultural counties, organized local community and county committees

during the year and carried forward some phase of the planning work. Analysis of local problems, the relation of those problems to State and national developments, and recommendations as to needed adjustments made up a major part of these preliminary discussions of land use.

In about 450 counties, more intensive land use planning was developed. The work of committees in these counties made available a more comprehensive basis for planning adjustments on individual farms, in extension programs, and in programs of other agencies of the Department of Agriculture.

In Michigan and Virginia, for example, land use maps which show recommended use of land in the area covered were prepared by local committees in practically all agricultural counties. In most other States such maps were prepared in selected counties, and plans were made for extending this part of the program to the remaining counties.

This comprehensive land use planning program has already made significant contributions to sound consideration of local, county, and State agricultural changes and adjustments. Its greater value will be more apparent as larger numbers of farm people have an opportunity to develop a broad understanding of the problems involved and to contribute to the planning. At the same time the program will make available more complete data and recommendations for those in charge of administering agricultural programs in the State and Nation.

Marketing Service Helps More Than a Million Farmers

Few lines of extension work have shown such rapid expansion as marketing. In little more than 6 years the increased interest in marketing has resulted in more than doubling the number of farmers benefiting from this extension activity. Records of county extension agents show that during 1938 approximately 1,200,000 farmers in 18,500 communities have been assisted with their marketing problems, either as individuals or as members of cooperative marketing groups. These farmers, largely through group-action and cooperative organizations, handled products valued at more than $640,000,000.

Much of the work has taken the form of field meetings, marketing schools, market tours, assistance to cooperatives, surveys and analysis work, exhibits, work with 4–H club and younger rural groups, and consideration of the costs of distribution, interstate barriers to trade, market facilities, and market outlets. During the past few years marketing extension specialists and county agents have also conducted a large number of discussion meetings covering a wide field of economic topics which included types and methods of marketing.

183555—40——2

With the development of marketing agreements, sponsored by the Agricultural Adjustment Administration, and somewhat similar programs established by State legislation, marketing specialists and county agents have developed teaching material and have held many meetings for the purpose of discussing with producers the economic bases and necessity for such programs. Similar assistance has been given local groups of farmers in organizing cooperative associations in keeping with the programs of the Farm Security Administration and Rural Electrification Administration.

Farm-Management Program Offers Many Services

A more insistent demand on the part of farmers for help in meeting their individual farm organization and management problems was apparent in 1938. Farm-management schools helped many farmers draw up long-time plans, including provision for most intelligent participation in national agricultural programs.

Farm records kept in cooperation with the Extension Service provided an invaluable background for much of the individual farm program planning. More than 57,000 such records were kept and analyzed with the aid of extension workers during the year, and many more thousands of farmers were provided with record books and assisted in a less formal way.

More satisfactory landlord-tenant relationships were forwarded in many States. Indiana provided improved lease forms to 776 farmers during the year, and gave a large amount of assistance in this field through meetings, personal conferences, and correspondence.

Ohio organized a series of leader-training schools involving the coordinated effort of several extension specialists in developing farm adjustments on the farm-unit basis. At these meetings local leaders were trained in working out coordinated plans for typical farms which considered all types of adjustments needed in the area to promote the best type of farm organization and operation.

Illinois conducted a series of coordinated farm planning schools involving various extension specialists, representatives of the Soil Conservation Service and Agricultural Adjustment Administration, and others. Eighty-six counties undertook this work in 1938, and 9,000 copies of a farm planning booklet entitled "Planning the Farm Business" were used by Illinois farmers.

Interprets Outlook Data

County and State extension workers assumed their familiar role of interpreter in helping farm people make the best possible use of available economic outlook material.

Iowa has developed a comprehensive program of getting outlook

and other economic information to farmers. Daily radio broadcasts give market information. A weekly leaflet summarizes current developments and is supplemented by monthly and quarterly summary statements directed toward economic problems of significance to rural Iowa. Other States use all or some of these methods of keeping farm people informed on market and economic trends throughout the year.

The annual outlook report prepared after a conference of State economists in Washington was widely distributed by county extension agents. In most States it was supplemented by a State outlook report, which was made the basis of study meetings of farmers and farm women and the basis for planning individual farm adjustment in the light of current economic conditions.

Agents Help Farmers Use Credit Wisely

Though emergency needs for credit and credit adjustment were not so acute in 1938, agents continued to meet a steady demand for information relating to the wise use of credit facilities.

Extension agents reported that they helped 241,760 farmers obtain needed credit. Of equal importance was the individual counsel given thousands of individuals who were faced with the necessity of adjusting indebtedness already incurred, and those who sought advice as to the most satisfactory type of credit for their needs.

Advisory service on credit is frequently requested by farmers' cooperative organizations, and extension agents and specialists continued to assist in this field. In all credit and finance activities the Extension Service cooperated closely with the Farm Credit Administration. In many States the Farm Security Administration has also become an important credit agency for families unable to borrow from other sources, and extension agents have been of much assistance to representatives and clients of that organization.

Gives Technical Advice on Crop Production

Providing farmers with technical information and practical advice in all lines of crop production in every agricultural area of the country continued in 1938 to stand high on the list of tasks assigned the county agent.

County agents helped farmers get seed of improved crop varieties and demonstrated methods of treating that seed to control seed-borne diseases. They recommended new and better ways of planning, fertilizer placement, cultivation, weed control, insect and disease control, harvesting, and storage of the matured crop.

Aided by national agricultural programs, county agents and farmers were able to make more rapid progress toward objectives long recog-

nized as fundamental to a stable, balanced agriculture. Particularly in the field of soil conservation, involving liming, use of legumes, terracing and similar practices varying with the region, progress was more rapid than ever before.

Better Varieties Widely Grown

Information on improved varieties of crops and sources of seed is one of the most appreciated services county agents give farmers. Once the research men have developed a new variety, and seed is available, extension agents quickly pass the information on to farmers and help selected farmers demonstrate the new variety. An outstanding example of this close relation between research and extension is the rust-resistant Thatcher wheat, introduced in 1934. In Minnesota it is estimated that 70 percent of the spring wheat sown in 1938 was of the Thatcher variety.

The practice of cottonseed treatment was demonstrated throughout several Southern States, and in the Carolinas, Georgia, and Virginia the acreage planted with treated seed more than doubled from 1937 to 1938.

One-Variety Cotton Campaign Moves Ahead

Organized seed-improvement programs were under way in 33 States making it possible for more farmers to get reliable supplies of good seed.

A good example is the one-variety cotton program in Louisiana, which has standardized on three cotton varieties, one for each of the three principal soil types. Seed coming into the State, not of an approved variety and not certified by a State seed improvement association, must carry a yellow tag stating that it is not approved by the State Seed Improvement Association for use in Louisiana. Other Southern States reported progress in the one-variety cotton campaign.

Fights Insect Pests and Other Parasites

Extension specialists and county agents, cooperating with other Federal and State agencies, carried on a grasshopper-control campaign in 25 States, most of them west of the Mississippi River. During this campaign 417,483 farmers cooperated in spreading 155,000 tons of poison bait on 59,424,984 acres.

Outbreaks of armyworms, cutworms, and wireworms were reported in many sections of the country, and extension agents were called on for advice in fighting those pests.

County agents continued during 1938 to help farmers control such serious livestock pests as horse bots, ox warbles, screwworms, kidney worms, and roundworms of swine. In Texas, for example, a sys-

tematic ox warble campaign resulted in 85-percent reduction in bots in cattle under range conditions. Almost complete eradication was reported from smaller herds in general farming areas.

Advice on when and how to spray for control of insects and diseases continued to be a major line of work in all fruit- and vegetable-producing sections of the country.

Aids in Forage and Pasture Improvement

Forage- and pasture-improvement work assumed particular importance in all areas where the beef and dairy cattle industry are major farm enterprises.

This part of the extension agronomy program has received much attention in recent years as a source of better and cheaper feed supplies, and as an aid in erosion control. One of the most systematic and intensive endeavors in this field is the Nebraska pasture-forage-livestock program, in which eight major recommendations of the Extension Service and other agencies along this line are set forth and widely distributed to farmers.

Because of the financial aid offered by the Agricultural Adjustment Administration program, many farmers were enabled to make applications of lime and fertilizer, sow legumes, and otherwise conduct their farming operations along lines recommended for years by county agents.

Offers Engineering Service to Farmers

Extension agricultural engineers and county agents were called upon in 1938 for many kinds of information relating to farm machinery, drainage, building construction and remodeling, and other subjects coming under the general heading of engineering.

Tractor and machinery-repair schools were held in many States. The almost complete disappearance of the blacksmith shop has made it necessary for farmers in thousands of communities to make more of their machinery repairs and adjustments on the farm. These schools, often extending over several days, bring expert advisers on repair problems, with special tools not often found in the farm shop.

In the South, better cotton harvesting, handling, and ginning was promoted in connection with the one-variety cotton community program. Cotton drying, ridiculed 6 years ago, increased rapidly in 1938, with more than 10 manufacturers supplying gins with driers.

The farm building-plan service was enlarged by selection of a large number of plans adapted to the Western States. These will be made available to builders and county agents, as similar plans have been made available for the Northeastern States and Midwest. A compilation of plans for farm buildings in the South is under way.

Home-management specialists and agricultural engineers worked together in most States, planning and carrying forward educational programs on home improvement and remodeling.

Rural electrification has been remarkably advanced throughout the country as a result of the Rural Electrification Administration program. Over 165,000 farms were connected with electric service in 1938, bringing the total to 1,406,579 farms, which provide service to nearly 22 percent of all the occupied farm dwellings. Fifteen hundred and sixty-five county extension offices reported a total of more than 21,000 hours given to assistance in this work by county agents and State specialists, in addition to over 22,000 farm people assisting on special rural electrification committees to plan for better use of electricity as well as for development of rural lines.

Extension Helps in Farm Forestry

Increased recognition of the place of forestry in farm management and land use was reported by extension foresters and county agents. The agricultural conservation program has stimulated tree planting on idle lands throughout the country. Agents reported that farmers planted approximately 140,000,000 trees for future timber, erosion-control, windbreak and shelterbelt protection, and 27,000 farmers thinned and pruned woodlands according to extension recommendations.

Texas and Arkansas were among the States in which agents placed particular emphasis on use of home-produced timber for construction and repair of farm buildings.

Educational work in connection with marketing forest products, both by individuals and through cooperatives, was forwarded in many parts of the country, and 16,000 farmers followed extension recommendations in marketing forest products. In the South, information on proper cutting methods assumed new importance, as new paper pulp mills sought sources of farm-grown timber.

In New England the hurricane of September 21 created a forestry problem unlike any previously experienced in that region. Extension agents and forestry specialists assisted in making a survey of damage done to timber stands, and assisted State forestry departments and the Forest Service in obtaining information necessary before a purchase program could be put into effect. With the creation of the Northeastern Timber Salvage Administration, extension agents acted as intermediaries between Government agencies and farmers.

Flock and Herd Improvement Makes Progress

Extension work with the millions of men and women who manage the production facilities in the Nation's huge livestock, dairy, and

poultry industries continued along lines contributing to economic stability, disease control, and lower cost of production.

In the field of animal health, extension agents continued to work closely with farmers and State and Federal agencies engaged in disease-eradication campaigns. Among the achievements of 1938 which county agents helped make possible was the practical eradication of bovine tuberculosis from the continental United States, with the exception of 10 California counties. As the year drew to a close, more than 10,000,000 cattle were under supervision for control of Bang's disease, and since 1934 nearly 29,000,000 cattle had been subjected to the agglutination blood test, with elimination of more than a million and a half diseased cattle. Eradication of cattle tick fever in the South continued to make progress during the year, with prospects of early completion of the campaign. Though not doing the eradication work, county agents had much to do with explaining these programs to farmers and encouraging and organizing them to take action in stamping out these costly livestock pests.

In Minnesota, where more than 45,000 horses were affected with sleeping sickness resulting in the death of more than 10,000 horses in 1937, nearly 7,000 farmers followed disease-control recommendations to meet the 1938 outbreak of this disease.

Dairy Program Centers on Herd Improvement

Lower cost of milk production was the objective behind many extension programs developed along lines of dairy-herd improvement, pasture and roughage improvement, and better dairy-farm management.

Almost 26,000 herds, a total of approximately 625,000 cows, were on test in the 1,228 dairy-herd improvement associations operating in the 48 States, Hawaii, and Puerto Rico. County agents and extension dairy specialists have been instrumental in organizing these associations and have encouraged farmers to take full advantage of dairy-herd improvement association records as a basis for efficient feeding and management programs and for proving sires.

Careful study and analysis of herd-improvement records makes it possible for the dairyman to plan a constructive breeding program. As these 26,000 herds supply much of the young stock purchased by dairymen, the dairy-herd improvement association program plays an important part in improvement of all dairy cattle Production records for the year show that there is still much room for improvement—cows on test in associations averaged 320 pounds of butterfat, while average production of all cows was 170 pounds.

Artificial-insemination associations, a new development in dairy farming, made possible more widespread use of superior sires selected

on the basis of production records. At the year's end the original New Jersey project had approximately 185 members with about 2,300 cows being bred to 6 sires. Associations were being organized in many other States.

Cooperative bull associations and bull studs were also increasingly popular as methods of making superior sires more generally available.

Poultry Improvement Reported

Poultry, important both as a major agricultural enterprise and as a part of all plans for "better living from the farm," continued to have an important place in the extension programs in most States.

Poultry specialists and extension agents assisted in forwarding the National Poultry Improvement Plan, which is administered by the Bureau of Animal Industry and official State agencies. Forty-four States cooperated in the breeding program or pullorum-disease control sections of the plans, and 1,478 hatcheries, with an egg capacity of more than 60,000,000 eggs from about 29,000 flocks, are producing improved chicks under the plan.

Educational work in egg grading and marketing moved forward, as a larger number of commercial packers adopted a policy of purchasing eggs on a graded basis. Cooperative egg auctions, through which growers received a premium for better quality eggs, also gave new weight to extension teaching and quality egg production.

Among the many other types of service most frequently given poultrymen and turkey growers were economic information, management methods for the farm flock, and disease and poultry-housing recommendations.

Poultry specialists in all States assisted in educational work in connection with the Seventh World's Poultry Congress.

Cold-Storage Lockers Meet Important Need

Farm families in many communities have taken a new interest in the production and preservation of a home-raised food supply since the coming of the freezer locker. Fresh, frozen, home-raised meats, fruits, vegetables, and poultry products are made available by these plants to lend variety to the diet and to supplement the supply of canned and salted foods.

In this connection, extension agents in 36 States are being called on to assist in planning a more adequate food-production program and to obtain the information necessary for successful operation of the hundreds of locker plants now operating. Interest in freezer-locker plants is spreading to neighboring communities and to the other States.

Better Living is Aim of Home Demonstration Program

Developing opportunities for better living on the farm has always been a primary objective of the home demonstration program for rural families. Through the help of 2,535 home demonstration agents and specialists, almost 2,000,000 families came closer to realizing that objective in 1938.

The home demonstration program, like homemaking itself, is comprehensive, including projects relating to nutrition, clothing, money management, household management, health, child care, home improvement, home crafts, and many other subjects.

While all home demonstration programs include practical considerations relating directly to home problems, 1938 brought an increase in cultural and community interests of farm women. Community activities were fostered, appreciation of good music and art was encouraged, and achievement days and recreation camps were sponsored by home demonstration groups in many States.

Home demonstration work has an important part in building a rural culture that is lasting and stimulating, and contributed toward that culture by bringing art into everyday life through good design and color in clothing, in home arts and crafts, and through greater attractiveness in farm-home furnishings and surroundings.

Planning Before Action

Home demonstration programs in the 47,010 communities with home demonstration clubs or groups were developed only after careful study of community and home needs. More than 1,000,000 women belonged to these organized groups and they set up goals for the year and a program designed to reach those goals.

Farm women assumed leadership and extension agents were assisted by 277,073 volunteer leaders in conducting home demonstration and 4–H Club work. These leaders, trained by home demonstration agents and specialists, conducted 162,641 meetings with a total attendance of more than 2½ million persons.

Foods Program Calls for Adequate Diet

Better living from the farm was the general theme of projects in almost every State. Foods projects emphasized the importance of an abundant supply of home-produced foods and full utilization of other farm products.

Better health through more adequate diets was an important part of the home demonstration program in more than 37,000 communities. Through meetings and demonstrations conducted by extension

183555—40——3

agents and trained local leaders, homemakers continued their study of what constitutes a generously adequate diet and then worked out the best available combination of home-produced and purchased foods to provide that diet.

As a part of this program, farm women and 4–H Club girls reported that they canned or otherwise preserved 70,000,000 quarts of fruits, vegetables, and meats. And, 168,989 families followed extension food-buying recommendations, while 407,310 families served better-balanced meals as a result of recommendations and demonstrations of home demonstration agents.

Boys and girls in 16,138 schools had better lunches because home demonstration groups, mothers' clubs, and similar organizations followed extension recommendations in providing hot dishes to supplement lunches brought from home. The soggy sandwich, wrapped in newspaper and warped, saucerlike, from close association with a heavily frosted cupcake, made fewer trips to school.

Throughout the Nation the foods and nutrition program was adapted to local conditions, with emphasis on meeting local needs with resources available to homemakers in the community.

Home-Management Program Offers Practical Help

The business side of homemaking received the attention of extension workers and homemakers in 22,940 communities. Working closely with extension agricultural engineers, home-management specialists in a number of States developed a comprehensive program of home improvement. Through meetings, demonstrations, and personal calls, home demonstration agents and specialists showed that many inexpensive repairs and improvements can make the farm home a more attractive and convenient place in which to live. Kitchen improvement, particularly, continued to be a popular project, and 103,399 kitchens were rearranged or otherwise made more convenient.

The large number of farm homes being wired for electricity brought many rural homemakers to their home demonstration agents for suggestions on lighting and electrical equipment.

Home accounts and budgeting of expenditures has long been an important part of the home-management program. Home demonstration agents reported that 37,614 families kept home accounts according to the plan recommended by the Extension Service.

Additional sources of income are always welcome, and often essential, in any any program of home improvement. Extension workers helped rural women find and develop these sources of income, and 37,136 families selected home industries as a desirable way to earn extra money. Curb and club markets, operated by farm women,

helped sell the products of home gardens and home industry direct to the consumer.

Better Ways To Use Clothing Money

Most farm families are constantly faced with the problem of making a little money go a long way in purchasing clothing and clothing materials. More than 600,000 women and girls followed Extension Service recommendations in construction of clothing, and 328,194 persons received assistance in renovation, care, and remodeling of clothing. The total estimated savings due to the clothing program amounted to $2,149,215 for adults and $704,249 for juniors, according to reports from home demonstration agents.

More Interest in Parent-Education Program

Increased appreciation of the importance of parent education and child development as a part of the home demonstration program was reported from many States. Participation of all members of the family in meeting mutual problems was one development reported in many homes. Other families took particular pains to obtain furnishings adapted to the needs of children, and to improve the habits of boys and girls. More than 136,987 men and women took part in the child-development and parent-education program.

Community Betterment Fostered

In a number of States almost every home demonstration group undertook some community-betterment project in addition to its regular program of home-economics work. Assistance to local charities, schools, and libraries was reported in thousands of communities. Other groups took the leadership in landscaping and cleaning up public grounds. In Mississippi alone, 12 community houses were built, and 2,978 churches or church grounds, 200 schoolhouses, and 200 rural cemeteries were improved. More than 16,000 families took part in a clean-up campaign in that State, which helped make their homes a pleasing part of a more attractive community.

Recreation also had an important place in the home demonstration program. Dramatics, orchestras and choruses, and social evenings to be enjoyed by all the family were among the more popular types of recreational activity reported.

Serving the Nation's Youth

Members of the 74,594 local 4–H Clubs active in 1938 established new high levels of achievement along many lines. The largest enrollment on record was reported with 1,286,029 boys and girls listed as

members, more than half a million of them for the first time. This record enrollment brought to approximately 7,500,000 the total number of young people who have received 4–H training since the work became Nation-wide in 1914.

As a part of their work club members "learn by doing." They raise a pig, plant and care for a garden, learn to sew, or acquire at first hand some other farm or home skill. Three-fourths of all these farm and home projects undertaken by club members were completed—another record for national 4–H achievement.

A total of 41,552 4–H judging teams and 57,255 demonstration teams were trained by extension agents. The judging teams helped club members learn to appreciate desirable standards in their project work, while the demonstration teams were important means of acquainting others with the information club members have acquired from their projects.

More Interest in Music and Radio

For the ninth consecutive year monthly national 4–H radio programs were made possible through the cooperation of the Department of Agriculture, State agricultural colleges, the National Broadcasting Co., and the United States Marine Band. The music-appreciation period of these programs was designed to stimulate the interest of club members in fine music. Other features on this national radio program included reports of 4–H activities and progress throughout the country. Nearly 40 States participated in the annual 4–H radio achievement program in November.

Club members in many counties and districts also presented regular and special 4–H radio programs over their local stations.

Club Camps Popular

Club camps were a recognized part of the club program in most States. A total of 3,230 such camps—county, district, or State—were held, attended by 150,311 boys and girls, together with 52,009 leaders and others.

The twelfth national 4–H Club camp brought outstanding club members and leaders from 43 States to Washington, and a somewhat similar camp for Negro 4–H Club members was held at Tuskegee Institute in Alabama.

More than 309,000 club members took part in the 10,389 tours arranged as a part of the club program. Many of the tours were conducted near the close of the club-project year, giving each club member an opportunity to inspect the project work of other members.

143,017 Volunteer Leaders at Work

No review of 4–H Club activities can overlook the important place of the local club leaders, who direct the individual clubs under the general supervision of county extension agents.

A total of 143,017 voluntary leaders, 46,749 of them older boys and girls and 96,268 adults, gave generously of their time and talent to help boys and girls with their enterprises.

The county leaders' conference continued as a vital factor in training local leaders, on the one hand, and in keeping extension agents in close touch with problems and thinking of the local leaders. State and county associations of club leaders played an increasingly active role during the year.

Clothing Project Still the Most Popular

The 737,857 girls enrolled in 4–H Clubs centered their club activities in projects with a direct bearing on the farm home. Clothing was again the most popular of all club projects, as it has been throughout the 24-year history of club work, and 433,437 girls were enrolled in that subject.

Attention centered around choice and selection of fabrics and garments; dressmaking, with particular emphasis on design, color harmony, and appropriateness; and choice of accessories.

Better Food-Handling Methods

The 4–H food-preservation project was participated in by 224,386 girls, who reported that they canned more than 9,000,000 jars of food products. Many did all the canning for the family. As another practical application of their knowledge of foods, 4–H Club girls planned, prepared, and served thousands of family meals, and many girls kept careful cost records. The widespread interest in food preparation is shown by the enrollment of 296,727 girls.

Room improvement was another popular project in many States, and hundreds of examples might be cited to show how a club girl, with very little money to spend, ingeniously built furniture, replanned and redecorated her room. Many girls also carried on projects in gardening and other lines of agriculture as well as in home management, home health and sanitation, and other fields.

Crop and Livestock Projects in Club Program

Agricultural projects for 4–H Club members were changed but little. Swine, corn, poultry, and garden projects attracted the largest number of boys.

Livestock projects were popular, although they require a larger initial cash outlay than do some others. Club boys in Hale County, Tex., carried on a feeding demonstration on 160 steers and 750 lambs. After the animals were exhibited at the Plainview Fat Stock Show they were shipped to Kansas City and sold at auction. The boys also went to Kansas City to see just what finally came of their feeding "demonstrators" and to learn the actual conditions under which their stock will be marketed when they are on their own in the livestock-feeding business.

Seventy counties in Indiana reported colt-club organizations with 949 boys and girls enrolled. The colts are the property and responsibility of the club members until the mature horse is ready for farm work or market.

Other livestock clubs were organized by club members in all parts of the country. The 57,573 dairy-club members reported that 54,707 animals were involved in that project. The 40,066 members of beef-cattle clubs raised 43,894 animals; 73,948 sheep were cared for by 24,789 members; and 176,485 pigs were reported by boys and girls carrying that project.

Poultry was again a favorite project with both boys and girls, as shown by the enrollment of 147,592 members with 4,444,219 birds.

Crop projects varied with the region, but found many club members working closely with seed-improvement organizations and following recommendations of field and garden crops specialists.

Club Members Practice Conservation

Increasing national interest in conservation led to greater activity in this field by 4–H Club members. Tree planting and other forestry projects attracted many, and other subjects in the broad field of wildlife, soil, and forest conservation formed the basis of other club projects for both girls and boys.

Practically every 4–H Club member in Kansas made some phase of conservation a part of his club program. Terracing, farm mapping, and soil testing were popular projects in several States. State 4–H conservation camps were held in approximately 30 States. In New York club members planted 1,168,000 trees in reforestation projects.

Program for Older Youth

Development of an extension program suited to older 4–H Club members and young people in their twenties was forwarded in many States. Several special studies of the interests and needs of this group of young people were conducted during the year. Youths of this age assisted county extension agents in forwarding the regular 4–H Club program, both by serving as leaders and by participating in county and local advisory councils.

Negro Agents at Work in 16 States

White extension agents in all Southern States gave information and assistance to Negro farmers and farm families. In addition there were 507 Negro agents at work in 16 States, an increase of 36 during the year.

Negro extension workers continued to emphasize a balanced farm and home program with special attention to a live-at-home plan for the farm family. Home industries, soil improvement, community improvement, rural housing, and health were important parts of the extension program for Negroes.

Richmond Harrison of Orrville, Ala., was one of many unit demonstrators who carried out a program for development of his whole farm organization. His program is comprehensive, extending over several years, and involves livestock improvement, farm records, and home improvements. In 1937 the little two-room cabin was replaced by a comfortable seven-room house. In 1938 the family decorated and equipped the home.

Harrison planted winter cover crops and summer legumes to build up his soil. He markets chickens and eggs and sells milk from five cows. He pioneered in establishing a milk route in the community, making it possible for other farmers to sell their milk. The agent reports that almost every other home in this community has made some improvement because of the example set on Harrison's farm.

Projects for both girls and boys were carried on by Negro 4-H Club members. Garden, poultry, crops, and canning were among the most popular projects.

Gardens for Health

Negro farmers throughout the South are encouraged by extension agents to plant gardens on land taken out of cotton production. Closely related to this is the continuous campaign for more home gardens and greater use of fresh vegetables as an aid to health. The suggested program provides for a garden large enough to supply fresh vegetables every day of the year, with an abundance of some vegetables for canning. Instruction in canning and in budgeting the food supply has gone hand in hand with this garden project.

Progress in Home Improvement

Clothing and home-improvement programs helped meet the needs of many Negro families, offering them assistance even when farm income was so low as to make major improvements impossible.

A direct result of the clothing project was improved workmanship, involving no additional expense and resulting in better-fitting garments.

Telling the Story of Agriculture

An organization created to give farm people practical information in the broad fields of agriculture and home economics cannot realize its full effectiveness without continuous use of all available methods of reaching the public. Through the press, radio, publications, letters, exhibits, and motion pictures, extension agents maintained a steady flow of informational material prepared in popular form to supplement personal contacts, local meetings, and demonstrations.

County extension agents cooperated closely with the weekly and daily press in all parts of the country, resulting in publication of 781,685 informational news stories relating to agriculture, home economics, and 4–H Club work. Many of these stories were purely local, dealing with progress made by individuals in meeting situations common on farms in the county. Other stories were adaptations of material prepared by State and Federal extension specialists, rewritten to give information of immediate practical value in the county. In addition to news stories, 463,018 different circular letters were issued by county extension agents.

Extension editors in most States maintained regular news services for daily and weekly papers, assisted in localizing information for their State, helped extension agents with information programs, and served newspaper editors with helpful material.

County extension agents in increasing numbers turned to radio as a means of informing farm people. A total of 19,293 radio talks were broadcast or prepared for broadcast by agents in the counties.

Local news, information from State and Federal extension specialists, and practical experiences of farm people were the types of material most frequently used in these broadcasts.

Bulletins Answer Many Requests

Bulletins published by the State agricultural colleges and United States Department of Agriculture offer one of the most satisfactory means of giving rather detailed information and instruction on many problems of farm and home.

Extension workers reported that they distributed 13,998,138 bulletins in 1938, most of them on request. More than 10,000,000 of these were State publications. Slightly more than 3,000,000 were Farmers' Bulletins and other publications of the United States Department of Agriculture, supplied to State extension offices through the Federal extension office.

Photographs and Other Visual Aids

Several hundred photographs from the Extension Service photographic library were selected by writers and editors of various publi-

cations, and more than 1,900 new photographs were added to the library. Thousands of photographs were also taken and distributed by State and county extension agents.

Thirty-five new film strips were prepared in the Federal office, and a total of approximately 16,000 film-strip positives were purchased by the Department or by States with Department authorization.

Department Exhibits Shown in 34 States

The Exhibits Section cooperated during the year with organizations in 34 States resulting in Department of Agriculture exhibits at 63 fairs, exhibitions, and other similar events. Attendance at the 45 State, interstate, and international fairs at which the Department exhibits were shown, exceeded 5,600,000. Carload groups of Department exhibits were shown at 20 State and interstate fairs.

The Section prepared 28 new exhibits and supervised production of 10 special units for the Agricultural Adjustment Administration. These special units, illustrating the place of soil-conserving crops and practices as an aid to balanced farming, were shown at 41 fairs and expositions attended by an estimated 1,600,000 persons. One hundred and eight exhibits were revised and renovated.

The Exhibits Section was assigned the task of planning and building the entire Federal exhibit on poultry for the Seventh World's Poultry Congress and Exposition held in Cleveland in 1939.

Millions See Department Motion Pictures

Motion pictures on Department of Agriculture films were shown to an estimated 7,500,000 persons during the year, with an estimated equal attendance at showings of Department prints purchased from the contractor with Department approval.

The great increase in the number of persons attending showings of Department films resulted in part from the cooperative arrangement for film distribution made with institutions in 12 States. Even so, it was necessary to decline more than 1,500 applications for Department films because of lack of prints and facilities for distribution.

Under a cooperative agreement with the Civilian Conservation Corps, approximately 1,500 prints of Department films were used in connection with educational programs of Civilian Conservation Corps enrollees. More than 99,000 enrollees were given agricultural film study periods each month.

Agents Study To Keep Informed

To keep themselves up to date on developments in agriculture and home economics, and in the profession of extension teaching, agents

183555—40——4

in all parts of the country took advantage of the various opportunities for professional improvement open to them.

Through the pages of the Extension Service Review, a monthly printed publication edited in Washington, D. C., the extension staff kept informed on national developments affecting the extension program. Special articles explaining extension methods and accomplishments in the various States offered new ideas to be used in meeting both old and new problems.

A survey shows that 480 extension workers from 34 States attended special summer training courses arranged for them at 14 State land-grant colleges.

Studies Point Way to More Effective Extension Work

A survey of the preparation and training of 7,873 State and county extension workers provided a more nearly scientific basis for readjusting college curricula for prospective extension workers.

Another survey made during the year shows that 27 States provide sabattic leave for State extension employees, and in 19 States county extension workers are also included in the leave-for-study plan.

Studies of the situations, problems, and interests of young people from 16 to 25 years of age, in Arkansas and South Carolina, were published during the year. Similar studies have been made in 7 States, at the request of a special committee of the Association of Land-Grant Colleges and Universities. These surveys are helpful in planning experimental extension programs for older rural youth.

Progress was made toward developing a broad program of measurements to determine how participation in 4-H Club work contributes to the educational growth of boys and girls. Special studies were undertaken in Massachusetts, Missouri, Ohio, and Iowa.

A study of more effective methods of extending home demonstration programs was made in three representative areas—Massachusetts, Washington, and South Carolina. Analysis of data on effectiveness of teaching means and agencies was continued during the year.

Funds and Personnel

County agents were at work on July 1, 1938, in 2,989 counties of the 3,147 in the 48 States, Hawaii, and Puerto Rico. Home demonstration agents were employed in 1,881 counties. There were in addition 1,567 extension specialists in the States and Territories. The Extension Service staff totaled 8,757 persons on July 1, 1938, an increase of 161 during the fiscal year.

Expenditures of Federal, State, and local funds for cooperative extension work during the fiscal year ended June 30, 1938, amounted to $32,255,456.41. Funds from sources within the States were

increased by $1,145,608.66 compared with 1937, and Federal extension funds were increased by $507,456.16.

Approximately 56 cents of every dollar spent for extension work came from Federal sources; 20 cents from State and college sources; 21 cents from county appropriations; and 3 cents from local organizations and individuals.

Of all extension funds, 97.9 percent was expended in the States and Territories, and the remaining 2.1 percent was spent for administrative activities in Washington. Of the money expended in the States and Territories, 64 percent went to county extension agents; 19 percent to State subject-matter specialists; and 17 percent for publications, administration, and service to the agents.

Thirteen States, Hawaii, and Puerto Rico did not spend their entire allotments of Federal funds and had balances remaining unexpended on June 30, 1938, as shown in table 12.

Statements of the funds expended in each State and territory, by sources, items of expense, and lines of work, are given in tables 13 to 15, inclusive.

Extension Loses Leaders

The retirement of C. B. Smith on October 31, 1938, brought to a close his 42-year career in the Department of Agriculture, three decades of which were spent as a national extension leader. Upon the passage of the Smith-Lever Act in 1914, Dr. Smith became chief of the Office of Extension Work, North and West, of the States Relations Service. In 1923 he became chief of the Office of Cooperative Extension Work for the whole country, and in 1932 he was appointed assistant director of extension, the position he held at the time of his retirement.

A. B. Graham, another pioneer in the field of agricultural extension, retired from the Extension Service on March 31, 1938. Since 1919 he had been in charge of the subject-matter section of the Federal Extension Service.

Herbert W. Mumford, dean of the College of Agriculture at the University of Illinois and director of extension work in that State, died May 31, 1938. He was succeeded by J. C. Blair.

Fred C. Meier, supervisor of county agricultural-agent work in the Northeastern States since 1934, was a passenger on the *Hawaii Clipper* lost at sea between Guam and Manila on July 29, 1938. Long a leader in the field of plant pathology, he was at the time engaged in an investigation of transmission of plant pollens and disease spores in upper air currents.

C. P. Close, extension horticulturist of the Federal Extension Service, retired January 31, 1938.

B. W. Ellis resigned as director of extension work in Connecticut and was succeeded by Roger B. Corbett on September 1, 1937.

F. W. Peck became president of the Federal Land Bank of St. Paul in January 1938, and P. E. Miller succeeded him as director of extension work in Minnesota.

A. Rodriguez Geigel was appointed director of extension work in Puerto Rico, July 1, 1937, when A. E. Bowman, who had served in that capacity during the previous year while on leave of absence from the University of Wyoming, returned to Wyoming as director.

George J. Baker became acting director of extension work in North Dakota in August 1937, when H. L. Walster relinquished that position.

J. O. Knapp was made acting director in West Virginia, February 1, 1938, when F. D. Fromme resigned to go to the Office of Experiment Stations in Washington, D. C.

Statistics

Results, 1938

TABLE 1.—*General summary of activities and influence, 1938*

Item	Number	Counties reporting
County associations fostering extension work	6,728	2,598
Membership in these associations	879,832	2,526
Communities in counties	82,347	2,963
Communities with extension program	64,212	2,740
Voluntary local leaders:		
Men leaders in adult work	227,526	2,610
Women leaders in adult work	216,001	2,503
Men leaders in 4-H Club work	35,196	2,630
Women leaders in 4-H Club work	61,072	2,673
Older boy leaders in 4-H Club work	19,760	1,704
Older girl leaders in 4-H Club work	26,989	1,824
Organized 4-H Clubs	74,594	2,933
Members in 4-H Clubs:		
Enrolled	1,286,029	2,918
Completed	959,078	2,880
4-H Club projects:		
Started	2,549,382	2,918
Completed	1,815,085	2,880
Groups organized for extension work with rural young people above club age	2,036	977
Membership in such groups	67,586	893
Clubs or other groups organized to carry on adult home demonstration work	47,010	2,366
Membership in such clubs or groups	1,104,490	2,355
Farms in counties with extension agents [1]	6,843,558	3,006
Farms on which changes in practices have definitely resulted from agricultural extension program	3,733,584	2,847
Homes in which changes in practices have definitely resulted from home demonstration program:		
Farm homes	1,332,950	2,368
Other homes	571,311	2,216
Homes with 4-H Club members enrolled:		
Farm homes	792,541	2,896
Other homes	194,425	2,525
Families influenced by some phase of the extension program:		
Farm families	4,634,774	2,916
Other families	890,597	2,779

[1] Census, 1935.

TABLE 2.—*Summary of activities by agricultural, home demonstration, and club agents, 1938*

General activities	Total for all lines of work		Reported by home demonstration agents		Reported by club agents [1]		Reported by county agricultural agents	
	Number	Counties reporting	Number	Counties reporting	Number	Counties reporting	Number	Counties reporting
	Percent	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*
Time devoted to Agricultural Adjustment Administration and relief work	13.93		0.56		2.38		21.83	
Time devoted to regular extension work	86.07		99.44		97.62		78.17	
Time devoted to field work	60.09		65.06		64.90		57.10	
Time devoted to office work	39.91		34.94		35.10		42.90	
	Number		*Number*		*Number*		*Number*	
4-H Clubs	74,594	2,933	30,980	1,713	15,289	458	38,827	2,505
Enrollment:								
Boys	548,172	2,918	26,390	391	141,207	456	410,574	2,527
Girls	737,857	2,805	508,274	1,712	92,299	321	174,099	1,619
Completions:								
Boys	407,329	2,880	19,704	376	106,841	454	304,714	2,487
Girls	551,749	2,786	365,867	1,683	76,755	320	138,912	1,598
4-H judging teams trained	41,552	2,184	21,834	876	2,585	368	17,557	1,686
4-H demonstration teams trained	57,255	2,083	31,485	1,126	5,375	318	21,991	1,353
Groups organized for extension work with rural young people above club age	2,036	977	1,000	511	183	121	1,380	730
Membership in such groups	67,586	893	31,080	509	8,230	115	43,343	721
Farm or home visits made	2,973,667	2,960	705,408	1,891	251,719	496	2,024,206	2,943
Different farms or homes visited	1,587,469	2,960	403,188	1,891	134,781	496	1,091,129	2,943
Office calls	22,123,152	2,961	1,191,170	1,880	263,903	469	20,695,320	2,948
Telephone calls	6,644,664	2,934	1,036,074	1,845	188,888	460	5,419,702	2,902
News articles published	781,685	2,950	249,524	1,874	42,047	477	492,804	2,926
Individual letters written	8,701,984	2,957	1,697,014	1,882	312,374	484	6,592,816	2,944
Different circular letters prepared	463,018	2,956	137,105	1,854	29,006	472	301,348	2,937
Bulletins distributed	13,998,138	2,953	5,558,980	1,875	611,669	464	7,827,489	2,930
Radio talks prepared	19,293	1,298	5,610	729	1,155	179	12,531	1,047
Events at which extension exhibits were shown	37,019	2,729	23,991	1,717	3,227	423	11,500	2,357
Adult leader-training meetings held	80,323	2,758	33,002	1,670	330	57	47,435	2,561
Leaders attending	1,597,611	2,508	564,954	1,659	8,012	45	1,035,546	2,478
4-H leader-training meetings held	29,326	2,546	12,457	1,420	3,246	389	15,637	1,895
Leaders attending	499,907	2,544	203,390	1,416	60,570	388	284,920	1,888
Method-demonstration meetings held	552,038	2,911	353,018	1,877	32,740	442	167,878	2,781
Attendance	10,057,941	2,903	6,235,668	1,875	570,900	441	3,341,404	2,773
Result-demonstration meetings held	98,046	2,451	42,431	1,160	4,962	221	51,154	2,219
Attendance	2,209,664	2,444	927,413	1,155	189,793	217	1,117,277	2,207
Adult tours conducted	9,685	2,261	3,220	945	96	38	6,564	2,014
Attendance	408,801	2,256	130,225	942	4,583	36	285,768	2,011
4-H Club tours conducted	10,389	1,917	1,973	626	2,291	358	6,784	1,507

Attendance	309,033	1,914	72,652	617	76,014	354	189,850	1,497
Achievement days held for adults	8,014	1,880	6,099	1,385	83	18	2,035	832
Attendance	1,244,551	1,870	723,798	1,378	14,302	17	620,587	828
Achievement days held for 4-H Clubs	16,018	2,495	7,546	1,474	2,807	376	7,183	1,852
Attendance	2,375,284	2,487	852,126	1,467	492,314	374	1,475,975	1,845
Farm women's club camps held	821		737		4		115	
Attendance	66,174	818	58,397	732	278	4	8,302	111
4-H Club camps held	2,201		1,274		340		1,654	
Attendance	202,320	1,956	103,574	1,279	37,856	335	108,759	1,623
Meetings held by agents	1,278,725	2,911	588,725	1,877	88,860	442	617,900	2,819
Attendance	44,782,473	2,903	18,463,381	1,875	3,970,894	441	24,060,260	2,812
Adult meetings held by local leaders not participated in by agents	277,888	2,421	162,641	1,538	1,489	47	117,567	1,982
Attendance	5,637,189	2,418	2,674,790	1,536	29,257	47	2,998,217	1,977
4-H Club meetings held by local leaders not participated in by agents	391,612	2,422	148,565	1,363	91,207	331	173,337	1,799
Attendance	5,702,681	2,417	2,481,523	1,356	1,187,935	330	2,469,586	1,796
Number of meetings at which discussion group method was followed	195,082	1,988	80,331	1,074	23,002	207	93,876	1,629

[1] Includes a small amount of work in counties without extension agents, reported by State club leaders.

TABLE 3.—*Summary of activities by projects, 1938*

Project or line of work	Counties reporting work	Days devoted to projects by agents and specialists	Communities in which work was conducted	Voluntary local leaders or committeemen assisting	Adult result demonstrations conducted	Meetings at result demonstrations	Method demonstration meetings held	Other meetings held	News stories published	Different circular letters issued	Farm or home visits made	Office calls received
Corn	2,483	38,079	29,878	23,265	20,692	4,220	7,690	8,967	14,197	6,773	86,456	354,086
Wheat	1,914	14,638	13,978	8,268	5,272	777	1,502	5,141	9,142	6,756	25,249	361,424
Oats	1,804	7,930	12,517	5,689	5,235	768	1,391	1,525	2,676	1,173	13,337	88,446
Rye	943	1,842	4,660	1,776	2,694	160	242	393	685	348	3,799	43,093
Barley	1,325	3,610	7,059	3,158	2,445	325	451	917	1,961	708	7,712	49,226
Other cereals	1,078	6,398	7,439	4,252	3,513	656	1,486	1,880	3,625	1,361	11,120	108,285
Alfalfa	2,049	15,448	17,045	9,510	9,559	1,052	1,644	4,015	6,962	2,844	31,857	205,756
Sweetclover	1,320	4,696	7,912	4,193	2,231	336	450	1,512	2,733	875	8,008	92,496
Other clovers	1,493	11,188	13,378	8,660	10,788	1,164	1,588	2,698	3,502	1,710	22,701	144,329
Vetch	1,041	9,435	10,822	6,407	11,618	1,624	2,724	2,685	2,198	1,338	17,340	176,239
Lespedeza	1,316	10,531	13,639	7,403	16,906	1,813	1,587	2,594	2,773	1,557	24,112	184,894
Pastures	2,430	27,719	25,923	15,644	20,862	3,445	4,119	5,891	9,489	4,725	59,029	280,785
Soybeans	1,688	6,671	12,055	5,301	5,745	514	1,121	1,540	2,785	1,177	13,310	130,618
Cowpeas and field peas	908	8,161	10,266	4,537	10,853	662	1,141	978	1,086	652	9,837	96,899
Velvetbeans	349	1,229	2,745	1,120	828	117	240	188	226	166	2,663	20,616
Field beans	309	1,277	3,039	712	748	72	154	250	317	261	3,692	11,906
Peanuts	559	5,117	5,329	2,664	3,203	541	1,514	911	828	763	9,318	96,514
Other legumes and forage crops	1,334	10,708	11,441	5,495	5,575	865	1,409	2,594	3,822	1,819	21,180	181,874
Potatoes	1,844	18,691	14,426	8,445	5,665	821	2,940	4,449	6,194	4,365	41,469	125,956
Sweetpotatoes	844	6,009	7,858	3,745	3,390	777	2,168	1,003	1,160	892	12,581	51,782
Cotton	983	44,138	17,266	17,729	26,731	2,771	6,203	12,589	11,402	9,814	70,626	2,275,795
Tobacco	712	19,677	5,562	4,615	4,885	818	3,071	4,351	4,312	3,966	39,606	826,189
Other special crops	822	10,177	5,299	2,787	2,734	873	1,279	2,626	2,418	1,604	26,018	138,605
Home gardens	2,481	41,702	36,156	28,408	63,927	5,976	20,516	12,277	12,762	9,711	110,599	187,936
Truck crops	1,525	19,267	11,001	6,874	9,269	1,580	3,465	3,680	5,873	3,502	46,836	118,064
Home grounds	2,209	30,189	25,697	23,010	40,171	6,149	18,127	7,957	12,312	6,488	68,247	102,496
Tree fruits	2,149	27,446	16,694	9,113	12,268	2,023	8,727	4,703	9,815	8,666	70,110	160,147
Bush and small fruits	1,339	6,852	7,880	3,479	5,533	799	2,612	1,284	2,585	1,582	14,656	39,993
Grapes	894	2,887	3,741	1,481	2,428	238	1,126	378	872	392	6,224	22,609
Forestry	2,184	18,318	18,754	10,937	6,106	1,154	5,538	5,474	9,264	4,040	29,107	113,612
Wildlife conservation	1,067	6,198	6,746	6,123	2,256	272	1,736	2,886	3,075	1,485	10,027	35,844
Agricultural engineering	2,572	78,326	30,008	31,200	30,026	6,508	23,955	15,099	19,934	11,413	144,735	513,940
Poultry	2,872	72,007	41,306	31,790	28,056	7,109	27,165	17,561	27,148	18,396	162,226	395,545
Bees	900	2,820	3,384	1,023	860	121	624	805	1,379	1,337	5,261	14,160
Dairy cattle	2,739	72,403	32,061	26,698	11,533	2,119	12,155	19,737	31,012	17,989	157,580	355,386
Beef cattle	2,533	46,614	23,504	15,103	6,033	1,867	12,343	10,018	16,248	8,889	112,306	275,371
Sheep	2,196	26,275	16,317	11,802	3,313	700	6,890	7,029	12,180	8,563	57,060	159,941
Swine	2,644	46,004	27,875	15,912	12,139	3,053	18,035	9,369	12,719	6,794	127,370	329,675
Horses and mules	2,020	13,147	15,741	10,729	4,349	545	3,617	3,762	7,145	3,578	38,931	111,221

Other livestock	576	2,692	2,109	754	178	62	508	956	754	393	5,613	20,884
Public problems	2,059	45,838	24,182	35,418	9,359	596	2,936	27,649	18,309	12,017	35,450	1,026,997
Farm records	2,069	24,869	18,476	10,263	13,091	1,031	3,056	3,820	5,325	5,640	48,998	109,551
Farm planning	1,649	19,452	13,575	6,138	8,677	902	1,880	3,498	2,810	2,126	38,685	232,656
Farm and home financing	1,675	11,399	16,165	3,989	2,655	224	664	2,661	3,380	1,226	12,662	226,586
Outlook	1,479	12,632	15,619	11,526	7,317	653	2,172	7,007	4,972	2,866	13,407	77,375
Marketing	1,892	26,206	18,607	13,213	7,802	939	3,226	9,149	10,906	8,140	37,307	278,208
Food selection and preparation	2,265	79,266	39,014	64,868	50,480	5,816	121,105	39,410	42,253	18,107	81,382	142,155
Food preservation	1,985	42,226	31,046	33,618	60,813	7,092	49,544	14,041	15,102	9,239	67,532	144,333
Child development	1,080	14,186	12,791	16,283	9,486	993	16,351	7,682	6,067	4,060	16,470	29,239
Clothing	2,375	102,802	42,280	72,627	48,038	6,429	163,306	69,245	44,770	20,538	110,453	181,262
Home management	1,654	37,396	22,940	30,582	22,113	3,087	43,675	14,188	20,094	9,124	46,243	73,249
House furnishings	1,923	59,967	30,102	42,297	33,083	6,212	80,272	18,904	27,501	10,938	75,450	105,158
Handicraft	1,029	16,078	15,011	16,302	19,707	1,644	22,610	8,353	3,839	3,040	19,994	35,997
Home health	1,498	18,823	24,663	26,790	20,545	2,477	22,483	13,525	8,552	4,076	32,438	45,597
Extension organization	2,692	271,223	58,270	165,773				148,648	100,580	70,683	235,148	1,213,168
Community activities	2,259	99,485	40,771	98,542				101,257	62,237	39,143	112,353	417,116
Predatory animals	306	1,407	977	834	170	18	152	189	377	156	1,237	7,189
Rodents	1,330	6,108	8,814	5,398	6,420	606	2,315	1,069	2,496	1,414	11,456	92,247
General feeder insects	1,805	24,138	19,873	28,932	20,783	1,109	4,598	4,616	13,123	5,203	47,053	446,547
Weeds	1,386	8,303	9,200	13,527	3,139	414	1,193	2,758	5,423	2,236	20,375	113,214
All other work	1,426	65,322	16,694	20,071	3,419	1,462	10,312	24,947	23,898	15,669	70,742	726,838
Cooperation with—												
Agricultural Conservation and Domestic Allotment	2,875	266,034	52,038	46,190				122,536	83,418	96,529	301,589	12,994,819
Soil Conservation Service	1,328	20,244	10,254	9,595				8,199	6,830	3,986	38,270	240,360
Farm Security Administration	1,687	13,740	14,259	4,734				5,334	2,237	1,159	17,778	164,712
Rural Electrification Administration	1,565	21,165	14,705	22,856				12,775	10,004	5,157	47,863	237,882
Tennessee Valley Authority	347	18,336	3,536	3,452				2,669	1,107	1,375	31,395	58,505
Works Progress Administration	583	4,124	3,740	2,518				2,817	1,126	703	13,083	47,366
National Youth Administration	587	4,609	2,805	1,274				1,837	549	320	4,169	19,557
Social Security Board, Public Health Service, and Children's Bureau	331	1,951	3,204	2,067				1,718	478	322	3,212	20,250
Other Federal agencies	454	5,020	3,791	2,435				3,345	1,122	687	7,346	66,310

TABLE 4.—*Summary of results with crops, 1938*

Project or line of work	Farmers following fertilizer recommendations	Farmers following insect-control recommendations	Farmers following disease-control recommendations	Farmers following marketing recommendations	Farmers assisted in using timely economic information as a basis for readjusting enterprise
Corn	336,167	229,356	118,005	117,160	541,275
Wheat	147,697	261,058	186,074	60,048	247,708
Oats	95,022	103,464	169,175	15,462	120,753
Rye	12,799	26,743	5,674	2,297	29,095
Barley	33,039	61,984	51,686	6,725	50,297
Other cereals	9,644	44,744	34,254	13,030	50,638
Alfalfa	117,051	93,627	11,512	8,959	98,534
Sweetclover	29,718	27,410	2,050	3,219	50,094
Other clovers	91,433	19,885	4,909	5,727	61,855
Vetch	59,905	7,379	6,505	2,801	58,278
Lespedeza	52,675	7,140	1,853	10,726	82,290
Pastures	92,960	47,982	1,896	4,917	113,966
Soybeans	37,523	10,009	2,563	20,460	95,358
Cowpeas and field peas	17,088	11,437	3,575	17,970	68,650
Velvetbeans	3,055	720	1,406	2,399	15,035
Field beans	7,387	9,502	9,081	4,616	6,781
Peanuts	21,581	2,298	1,443	26,451	43,289
Other legumes and forage crops	34,569	14,269	4,327	4,248	52,407
Potatoes	87,138	184,140	106,351	36,743	64,684
Sweetpotatoes	39,000	16,169	35,765	16,093	30,092
Cotton	333,592	223,527	115,706	273,092	660,352
Tobacco	147,887	99,227	78,937	68,196	143,413
Other special crops	34,197	19,722	17,359	15,709	20,642
Home gardens	205,898	380,009	190,920	36,412	134,821
Truck crops	62,011	75,516	51,124	38,394	40,619
Tree fruits	47,502	100,574	85,883	19,769	30,395
Bush and small fruits	20,898	26,188	20,701	11,248	15,627
Grapes	5,777	13,939	12,922	2,548	5,712

TABLE 5.—*Summary of results with livestock, 1938*

Project or line of work	Dairy cattle	Beef cattle	Sheep	Swine	Horses and mules	Other livestock
Farmers assisted in obtaining purebred sires	16,430	15,885	14,715	21,041	2,536	584
Farmers assisted in obtaining high-grade or purebred females	18,768	10,097	11,334	21,202	3,901	526
Bull, boar, ram, or stallion circles organized or assisted	855	241	123	382	239	18
Members in such circles	11,409	4,477	1,639	4,708	8,638	331
Herd-improvement associations organized or assisted	1,717	186	212	178	76	13
Members in such associations	33,951	9,252	13,665	5,994	4,378	335
Farmers not in associations keeping performance records of animals	22,325	2,974	2,301	5,141	1,647	46
Families assisted in home butchering, meat cutting, and curing		17,156	2,863	42,911		376
Families assisted in butter and cheese making	26,341					
Farmers following parasite-control recommendations	37,450	30,243	107,832	106,290	135,601	3,507
Farmers following disease-control recommendations	316,024	111,427	36,356	232,727	92,759	4,797
Farmers following marketing recommendations	73,059	38,519	43,708	101,987	2,472	865
Farmers assisted in using timely economic information as a basis for readjusting enterprise	126,778	68,389	43,626	134,700	26,574	1,053

TABLE 6.—*Summary of results with forestry, engineering, and conservation, 1938*

Project or line of work	Number	Counties reporting
Forestry:		
4-H Club members not in special clubs who participated in forestry activities	20,318	282
Farms on which new areas were reforested by planting small trees	32,487	1,443
Acres involved	140,043	1,355
Farmers planting windbreaks or shelterbelts	24,431	936
Farmers planting trees for erosion control	67,723	922
Farmers making improved thinnings and weedings	26,797	968
Farmers practicing selection cutting	31,744	783
Farmers pruning forest trees	13,911	539
Farmers cooperating in prevention of forest fire	319,018	738
Farmers adopting improved practices in production of naval stores	6,206	103
Farmers adopting improved practices in production of maple sugar and sirup	4,313	154
Farmers assisted in timber estimating and appraisal	3,791	438
Farmers following wood-preservation recommendations	21,109	485
Farmers following recommendations in the marketing of forest products	16,199	504
Wildlife:		
4-H Club members not in special clubs who participated in wildlife conservation	23,888	304
Farms on which specific improvements for wildlife have been made	23,390	573
4-H Club members engaged in rabbit activity	1,368	167
Rabbits produced by 4-H Club members	9,281	117
Adults engaged in rabbit activity	889	71
Rabbits produced by adults	6,044	40
4-H Club members engaged in fox and other fur-animal activities	263	33
Animals produced by 4-H Club members	1,191	20
Adults engaged in fox and other fur-animal activities	605	90
Animals produced by adults	10,479	50
4-H Club members engaged in game-bird activity	9,727	453
Game birds produced by 4-H Club members	50,240	267
Adults engaged in game-bird activity	17,012	422
Game birds produced by adults	912,055	253
4-H Club members engaged in conservation-camp activity	2,481	414
Adults engaged in conservation-camp activity	940	139
Agricultural engineering:		
Farmers following improved drainage practices	24,728	991
Farmers following improved irrigation practices	9,593	594
Farmers following land-clearing practices	14,813	438
Farmers using better types of machines	28,712	811
Farmers following recommendations in the maintenance and repair of machines	59,198	674
Farmers following recommendations in the efficient use of machinery	26,715	470
Farmers practicing better ginning of cotton	77,026	238
Farmers constructing buildings according to recommendations	79,770	2,039
Farmers having buildings remodeled, repaired, or painted	85,174	1,539
Farmers installing electrification units	220,236	1,305
Homes in which improved equipment was used	91,617	888
Dwellings constructed according to plans furnished	6,993	748
Dwellings remodeled according to plans furnished	18,918	814
Sewage systems installed	8,780	1,003
Water systems installed	15,027	1,108
Heating systems installed	4,836	447
Lighting systems installed	101,294	1,024
Home appliances and machines installed	132,632	793
Dairy buildings erected or remodeled	9,976	1,114
Silos erected	3,208	592
Trench or pit silos constructed	14,556	1,045
Hog houses erected or remodeled	15,757	1,147
Poultry houses erected or remodeled	32,858	1,874
Storage structures erected or remodeled	28,723	968
Other farm buildings erected or remodeled	26,111	877
Soil conservation:		
Farmers testing for soil acidity	173,194	1,359
Acres involved	2,931,755	1,105
Farmers applying lime materials	334,922	1,447
Tons involved	5,763,674	1,373
Farmers testing for plant-food deficiencies	86,234	997
Acres involved	1,566,383	836
Farmers applying recommended fertilizers	528,511	1,613
Tons involved	3,480,285	1,465
Farmers practicing proper land use based on soil types	120,003	739
Acres involved	9,481,986	648
Farmers using recommended crop rotations	601,483	1,620
Acres involved	36,304,491	1,461
Farmers plowing under green manure	504,869	1,705
Acres involved	6,925,626	1,593
Farmers controlling soil blowing	100,795	421
Acres involved	14,513,209	393
Farmers practicing strip cropping	62,050	940
Acres involved	3,286,469	871
Farmers using cover crops	645,533	1,461
Acres involved	13,271,250	1,375

TABLE 6.—*Summary of results with forestry, engineering, and conservation, 1938*—Continued

Project or line of work	Number	Counties reporting
Farmers practicing approved summer-fallow	143,762	638
Acres involved	7,649,924	613
Farmers constructing terraces	80,383	1,162
Acres involved	2,173,016	1,105
Farmers controlling gullies	65,605	997
Acres involved	1,950,403	887
Farmers growing crops on contour	265,971	1,038
Acres involved	10,741,995	964
Farmers practicing pasture and range improvement by contouring	16,005	721
Acres involved	1,759,333	681
Farmers grassing waterways	25,058	604
Acres involved	352,657	508
Farmers making depth-of-moisture tests	6,971	139
Acres involved	1,267,412	115
Farmers practicing floodwater control for crop production	7,362	182
Acres involved	387,477	174

TABLE 7.—*Summary of results in agricultural economics, 1938*

Project or line of work	Number or value	Counties reporting
Farm management:		
Farmers keeping regular farm accounts throughout the year	57,013	1,869
Farmers keeping Agricultural Adjustment Administration farm accounts throughout the year	121,888	716
Farmers keeping cost-of-production records	42,355	1,183
Farmers assisted in summarizing and interpreting their accounts	45,975	1,636
Farmers assisted in making inventory or credit statements	48,888	1,333
Farmers assisted in obtaining credit	241,760	2,174
Farmers assisted in making mortgage or other debt adjustments	29,103	1,164
Farm credit associations assisted in organizing during the year	317	144
Farm business or enterprise-survey records taken	22,389	359
Farmers making recommended changes in their business as a result of keeping accounts or survey records	44,519	1,228
Other farmers adopting cropping, livestock, or complete farming systems according to recommendations	301,454	1,490
Farmers advised relative to leases	64,244	1,799
Farmers assisted in developing supplemental sources of income	130,509	1,387
Families assisted in reducing cash expenditure by exchange of labor or machinery	29,453	593
Families assisted in reducing cash expenditure by bartering farm or home products for other commodities or services	61,926	621
Families assisted in reducing cash expenditures by producing larger part of food on farm	405,897	1,257
Families assisted in reducing cash expenditure by making own repairs of buildings and machinery	73,351	918
Urban families assisted in getting established on farms	14,734	1,139
Farm families on relief assisted to become self-supporting	27,017	815
Marketing:		
Marketing associations or groups assisted in organizing	1,359	659
Previously organized associations assisted	5,348	1,694
Membership in all groups assisted	889,591	1,582
Organizations assisted with problems of—		
Standardizing, packaging, or grading	1,723	763
Processing or manufacturing	559	290
Locating markets and transportation	1,597	783
Use of current market information	2,359	839
Financing	1,258	634
Organization	1,942	859
Accounting	918	460
Keeping members informed	3,561	1,162
Individuals (not in organizations) assisted with problems of—		
Standardizing, packaging, or grading	70,728	781
Processing or manufacturing	18,131	268
Locating markets and transportation	76,710	966
Use of current market information	150,374	999
Individuals (not in associations) assisted with marketing problems	325,577	1,800
Products sold:		
By groups organized or assisted	$357,090,389	507
By individuals (not in organizations)	$100,578,234	631
Supplies purchased:		
By groups organized or assisted	$55,807,815	640
By individuals (not in organizations)	$13,462,491	541

TABLE 8.—*Summary of results with home economics projects, 1938*

Project or line of work	Number or value	Counties reporting
Foods and nutrition:		
Families budgeting food expenditures for a year	77,173	1,049
Families following food-buying recommendations	168,989	1,157
Families serving better-balanced meals	407,310	1,772
Families improving home-packed lunches	168,929	1,271
Schools following recommendations for a hot dish or school lunch	16,138	926
Children involved	676,168	890
Families following recommended methods of child feeding	98,870	1,073
Individuals adopting recommendations for corrective feeding	130,656	1,008
Families producing and preserving home food supply according to annual food-supply budget	219,197	1,339
Families assisted in canning or otherwise preserving of fruits, vegetables, and meats	696,987	1,832
Quarts canned by families reported under preceding item	61,808,677	1,658
Other containers of jam, jelly, or other products made by families	13,916,343	1,465
Estimated value of all products canned or otherwise preserved	$20,866,497	1,721
Families following recommendations for the storage of home food supply	180,449	1,424
Families assisted in using timely economic information as a basis for readjusting family food supply	270,486	1,219
Child development and parent education:		
4-H Club members not in special child development projects who participated in definite child-development work	19,039	202
Families improving habits of children	72,806	742
Families substituting positive methods of discipline for negative ones	31,946	563
Families providing recommended play equipment	32,848	659
Families following recommendations regarding furnishings adapted to children's needs	23,884	579
Different men participating in child-development and parent-education program	10,296	211
Different women participating in child-development and parent-education program	126,691	780
Children involved in program	259,473	683
Handicraft: Families following recommendations regarding handicraft	127,805	931
Home health and sanitation:		
4-H Club members not in special health projects who participated in definite health-improvement work:		
Boys	49,076	437
Girls	152,393	893
Individuals having health examination on recommendation of extension workers or participating in health contests:		
4-H Club members	121,739	1,102
Others	54,459	477
Individuals improving health habits	446,014	1,227
Individuals improving posture	171,611	1,194
Individuals adopting recommended positive preventive measures to improve health	364,050	758
Families adopting better home-nursing procedure	58,028	651
Families installing sanitary closets or outhouses	54,328	870
Houses screened	75,378	817
Families following other recommended methods of controlling flies, mosquitoes, and other insects	109,989	847
Individuals enjoying improved health as a result of health and sanitation program	526,669	758
Community or country-life activities:		
Communities assisted in making social or country-life surveys, or in scoring themselves or their community organizations	6,785	480
Country-life conferences or training meetings conducted for community leaders	5,769	687
Community groups assisted with organization or programs of activities, or meetings	28,012	1,492
Communities developing recreation	18,953	1,246
Families following recommendations as to home recreation	109,027	899
Community or county-wide pageants or plays presented	9,563	944
Community houses, clubhouses, permanent camps, or community rest rooms established for adults	901	383
Community houses, clubhouses, permanent camps, or community rest rooms established for juniors	511	218
Communities assisted in establishing work centers for activities such as canning, seed treatment, and meat curing	1,579	300
Communities assisted in improving hygienic or public welfare practices	6,907	520
School or other community grounds improved in accordance with plans furnished	5,705	793
Communities assisted in providing library facilities	5,328	668
4-H Clubs engaging in community activities, such as improving school grounds and conducting local fairs	17,191	1,266
Families aided in obtaining assistance from Red Cross or other relief agency	38,344	650
Clothing:		
Individuals following recommendations in construction of clothing:		
Adults	302,572	1,580
Juniors	298,434	1,827
Individuals following recommendations in the selection of clothing:		
Adults	271,826	1,450
Juniors	230,200	1,666

TABLE 8.—*Summary of results with home economics projects, 1938*—Continued

Project or line of work	Number or value	Counties reporting
Clothing—Continued.		
Individuals keeping clothing accounts:		
Adults	42,168	934
Juniors	78,000	1,232
Individuals budgeting clothing expenditures:		
Adults	39,198	810
Juniors	34,582	831
Families following clothing-buying recommendations	169,838	1,177
Individuals improving children's clothing:		
Adults	113,341	1,038
Juniors	35,521	614
Individuals following recommendations in improving care, renovation, and remodeling of clothing:		
Adults	235,119	1,325
Juniors	93,075	1,033
Families assisted in using timely economic information in determining how best to meet clothing requirements	151,895	882
Estimated savings due to clothing program:		
Adults	$2,149,215	1,278
Juniors	704,249	1,432
Home management:		
Kitchens rearranged or improved for convenience	103,399	1,452
Families following recommendations in obtaining labor-saving equipment	101,852	1,267
Families adopting recommended laundering methods	66,916	878
Families assisted in home soap making	52,524	702
Families adopting recommended methods in care of house	159,005	1,097
Families assisted in constructing home-made equipment or conveniences	133,091	1,342
Women following a recommended schedule for home activities	58,279	759
4-H Club members keeping personal accounts	36,346	846
Families keeping home accounts according to a recommended plan	37,614	1,180
Families budgeting expenditures in relation to income according to a recommended plan	25,327	767
Families assisted in developing home industries as a means of supplementing income	37,136	695
Families following recommended methods in buying for the home	86,978	1,008
Families assisted in using timely economic information as a basis for readjusting family living	92,768	781
Families assisted in making adjustments in homemaking to gain a more satisfactory standard of living	196,858	1,070
Families having increased time for rest and leisure activities as a result of the home-management program	90,690	745
Total estimated savings due to home-management program	$1,095,359	792
House furnishings:		
Families improving selection of household furnishings	178,919	1,378
Families following recommendations in improving methods of repairing, remodeling, or refinishing furniture	172,636	1,508
Families following recommendations in improving treatment of windows	147,289	1,373
Families following recommendations in improving arrangement of rooms	158,101	1,416
Families improving treatment of walls, woodwork, and floors	150,772	1,389
Families applying principles of color and design in improving appearance of rooms	160,076	1,447
Total estimated savings due to house-furnishing program	$1,567,160	1,117

TABLE 9.—*Summary of results with poultry and miscellaneous subjects, 1938*

Project or line of work	Number or value	Counties reporting
Poultry:		
Families following an organized improved breeding plan as recommended	85,129	1,739
Families following recommendations in purchasing baby chicks	252,607	2,265
Families following recommendations in chick rearing	310,570	2,448
Families following production-feeding recommendations	292,411	2,441
Families following sanitation recommendations in disease and parasite control	286,513	2,515
Families improving poultry-house equipment	92,118	2,377
Families following marketing recommendations	123,891	1,582
Families assisted in using timely economic information as a basis for readjusting enterprise	151,440	1,557
Bees:		
Farmers following recommendations in transferring colonies to modern hives	5,279	432
Colonies involved	33,233	402
Farmers following disease-control recommendations	11,627	457
Farmers following requeening recommendations	3,538	358
Farmers following marketing recommendations	2,272	221
Predatory animals:		
Farmers following recommendations	3,934	138
Estimated savings due to control program	$300,472	106
Rodents:		
Farmers following recommendations	160,132	798
Pounds of poison bait used	3,386,953	703
Estimated savings due to control program	$7,894,570	666
General feeder insects:		
Farmers following recommendations	623,527	1,322
Pounds of poison bait used	284,318,740	1,209
Estimated savings due to control program	$116,109,516	1,097
Weeds:		
Farmers following recommendations	101,274	820
Pounds of poison used	7,815,112	558
Estimated savings due to control program	$2,873,588	474
Cooperation with Federal agencies:		
Farms or homes directly assisted by extension agents to carry out program of—		
Agricultural Conservation and Domestic Allotment	2,513,037	2,181
Soil Conservation Service	100,666	765
Farm Security Administration	51,242	1,092
Rural Electrification Administration	183,454	927
Tennessee Valley Authority	14,085	246
Works Progress Administration	30,755	263
National Youth Administration	7,283	323
Social Security Board, Public Health Service, and Children's Bureau	16,294	165
Other Federal agencies	22,385	213

TABLE 10.—*Summary of results of boys' and girls' projects,*[1] *1938*

Project	Boys enrolled	Girls enrolled	Boys completing	Girls completing	Units involved in club work	Quantity produced
	Number	*Number*	*Number*	*Number*	*Acres*	
Corn	86,940	1,389	62,526	1,087	106,903	3,819,668 bushels.
Wheat	3,186	29	2,619	27	15,566	325,952 bushels.
Oats	1,768	6	1,355	6	6,332	167,112 bushels.
Rye	122	1	85	1	187	2,942 bushels.
Barley	804	8	651	7	3,127	74,357 bushels.
Other cereals	5,984	87	4,519	79	18,407	
Alfalfa	414	11	297	9	778	336 bushels. 2,180 tons.
Sweetclover	92	1	53	1	72	775 bushels. 85 tons.
Other clovers	1,642	10	836	10	585	2,446 bushels. 187 tons.
Vetch	1,253	0	834	0	938	244 bushels. 283 tons.
Lespedeza	233	5	162	2	439	1,146 bushels. 349 tons.
Pastures	867	12	597	9	5,502	
Soybeans	2,583	7	1,499	6	2,443	20,615 bushels. 3,275 tons.
Cowpeas and field peas	1,912	135	1,459	60	1,920	17,463 bushels. 2,317 tons.
Velvetbeans	263	8	170	4	154	707 bushels. 65 tons.
Field beans	776	36	647	26	742	11,079 bushels. 194 tons.
Peanuts	11,619	555	7,776	391	7,037	3,730,119 pounds. 3,149 tons.
Other legumes	1,445	19	1,132	15	3,503	12,784 bushels. 1,853 tons.
Potatoes	23,006	1,888	17,578	1,430	9,295	885,320 bushels.
Sweetpotatoes	8,078	513	5,800	401	3,933	301,453 bushels.
Cotton	33,591	495	22,326	327	37,147	27,474,342 pounds.
Tobacco	14,222	1,386	11,301	1,119	6,088	4,741,261 pounds.
Other special crops	2,561	281	1,931	151	1,401	
Home gardens	56,543	160,959	40,608	110,206	35,725	1,491,183 bushels.
Market-gardening, truck, and canning crops.	6,718	5,981	4,485	3,664	4,232	263,071 bushels.
Beautification of home grounds	7,734	92,888	5,293	64,817		
Tree fruits	1,842	11,792	1,176	5,892	2,616	152,818 bushels.
Bush and small fruits	3,289	12,371	2,358	6,123	2,028	16,021 bushels.
Grapes	304	3,200	224	1,698	469	4,354 bushels.
Forestry	18,743	6,182	13,788	4,842	[2] 152,407	

Project	Boys enrolled	Girls enrolled	Boys completing	Girls completing	Units involved in club work
Wildlife conservation	10,861	7,469	7,613	5,223	49,947.
Agricultural engineering	13,429	1,368	9,576	987	78,809.
Poultry	71,123	76,469	49,765	53,925	4,444,219 birds.
Bees	1,570	150	1,142	138	6,811 colonies.
Dairy cattle	49,221	8,352	37,278	6,460	54,707 animals.
Beef cattle	36,349	3,717	28,603	3,096	43,894 animals.
Sheep	21,388	3,410	16,644	2,788	73,948 animals.
Swine	110,662	5,443	75,056	3,997	176,485 animals
Horses and mules	7,591	494	5,812	396	7,162 animals.
Other livestock	2,932	341	2,110	142	13,836 animals.
Farm management	5,032	942	3,415	583	
Food selection	7,979	296,727	6,082	220,258	
Food preservation	866	224,386	558	152,019	9,183,275 jars.
Child training	303	6,723	185	4,883	
Clothing	3,581	433,437	2,550	321,866	369,758 dresses. 1,170,050 articles.
Home management	369	45,102	296	31,150	43,097.
House furnishings	1,526	147,020	993	99,510	71,022 rooms. 370,817 articles.
Handicraft	22,539	51,128	18,448	36,572	182,466 articles.
Home health and sanitation	57,955	173,403	38,759	117,495	
Leadership	7,624	10,898	6,443	8,986	
Miscellaneous	10,246	10,468	7,948	8,840	
Total	741,680	1,807,702	533,361	1,281,724	

[1] 1 club member may engage in 2 or more projects. The sum of the projects is therefore greater than the number of different clubs and club members involved.

[2] Includes transplant beds.

TABLE 11.—*Number of counties with county agricultural and home demonstration agents (white), July 1, 1934–38*

State	Counties in State	1934		1935		1936		1937		1938	
		Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Alabama	67	67	5	67	44	67	58	67	58	67	66
Arizona	14	11	[1] 6	11	[1] 6	11	[1] 10	11	[1] 10	12	[1] 10
Arkansas	75	75	66	75	72	75	75	75	75	75	75
California	58	41	25	43	25	42	27	43	30	42	30
Colorado	63	42	7	45	5	46	14	[1] 51	[1] 15	[1] 51	17
Connecticut	8	8	8	8	8	8	8	8	8	8	8
Delaware	3	3	3	3	3	3	3	3	3	3	3
Florida	67	41	26	44	29	52	34	[1] 55	36	[1] 56	37
Georgia	159	[1] 153	[1] 85	155	[1] 80	[1] 159	[1] 84	[1] 159	[1] 88	[1] 159	91
Idaho	44	28	[1] 41	31	[1] 37	29	[1] 36	30	[1] 37	31	30
Illinois	102	[1] 100	[1] 37	97	[1] 39	[1] 100	[1] 44	[1] 100	[1] 56	[1] 101	[1] 60
Indiana	92	92	10	91	12	[1] 82	[1] 22	[1] 87	[1] 42	91	45
Iowa	99	99	[1] 26	99	[1] 35	99	[1] 68	99	[1] 63	99	[1] 77
Kansas	105	100	25	100	27	103	28	102	36	102	40
Kentucky	120	112	29	114	26	117	31	120	46	120	56
Louisiana	64	62	40	62	52	63	54	64	[1] 62	64	[1] 62
Maine	16	16	16	16	[1] 15	[1] 16	[1] 16	[1] 16	[1] 16	[1] 16	[1] 16
Maryland	23	23	23	23	23	23	23	23	23	23	23
Massachusetts	14	11	10	11	10	11	10	11	10	11	10
Michigan	83	70	5	73	5	74	[1] 41	[1] 77	[1] 40	[1] 81	[1] 40
Minnesota	87	[1] 81	10	86	11	[1] 87	21	[1] 87	22	87	23
Mississippi	82	78	[1] 56	79	[1] 69	82	[1] 78	82	[1] 77	82	71
Missouri	114	[1] 114	15	114	14	[1] 114	[1] 26	[1] 114	[1] 59	[1] 114	[1] 65
Montana	56	[1] 39	10	40	8	43	11	[1] 45	[1] 13	[1] 46	[1] 13
Nebraska	93	[1] 90	15	[1] 93	14	[1] 93	[1] 27	[1] 92	[1] 29	[1] 93	[1] 24
Nevada	17	[1] 13	[1] 6	14	[1] 6	[1] 14	[1] 6	[1] 15	6	[1] 14	[1] 5
New Hampshire	10	10	10	10	10	10	10	10	10	10	10
New Jersey	21	19	15	19	15	19	15	19	16	20	17
New Mexico	31	21	[1] 12	24	[1] 10	26	[1] 11	30	[1] 16	[1] 31	[1] 17
New York	62	50	33	51	37	54	36	55	38	55	40
North Carolina	100	93	54	97	53	98	78	100	76	100	79
North Dakota	53	52	4	53	4	52	5	52	7	50	11
Ohio	88	84	21	84	22	86	34	88	40	87	46
Oklahoma	77	77	60	77	68	77	76	77	77	77	77
Oregon	36	32	7	34	6	34	8	36	7	[1] 36	11
Pennsylvania	67	65	[1] 63	65	[1] 63	65	65	65	[1] 65	66	[1] 66
Rhode Island	5	[1] 5	[1] 5	[1] 5	[1] 5	[1] 5	[1] 5	[1] 5	[1] 5	[1] 5	[1] 5
South Carolina	46	46	46	46	46	46	46	46	46	46	46
South Dakota	69	[1] 69	[1] 26	69	[1] 27	[1] 65	[1] 31	[1] 62	[1] 30	[1] 62	[1] 37
Tennessee	95	94	38	95	42	95	65	95	64	95	66
Texas	254	[1] 235	[1] 144	235	151	[1] 242	[1] 165	[1] 254	172	[1] 254	180
Utah	29	20	[1] 8	21	8	[1] 24	9	25	[1] 8	[1] 25	[1] 8
Vermont	14	14	11	14	11	14	[1] 14	13	[1] 14	14	[1] 14
Virginia	100	[1] 92	41	93	42	[1] 94	[1] 46	98	[1] 53	[1] 99	[1] 57
Washington	39	38	10	38	8	[1] 39	11	38	10	39	[1] 18
West Virginia	55	44	[1] 28	44	[1] 27	[1] 49	27	48	[1] 30	48	[1] 34
Wisconsin	71	60	[1] 8	65	[1] 7	63	19	64	24	66	24
Wyoming	23	21	6	20	7	20	6	20	7	20	8
Hawaii	5	4	4	4	4	4	4	5	4	4	4
Puerto Rico	72					29	8	34	10	32	15
Total	3,147	2,814	1,305	2,857	1,348	2,922	1,649	2,976	1,789	2,989	1,881

[1] Some agents serve 2 or more counties.

Funds, 1938

TABLE 12.—*Unexpended balances of Federal extension funds for the year ended June 30, 1938*

State	Smith-Lever	Bankhead-Jones	Capper-Ketcham	Additional cooperative	Total
Alabama		$45,969.53			$45,969.53
Connecticut	$3.20	7.41	$27.08	$100.57	138.26
Delaware		2,266.36			2,266.36
Illinois		11,317.13			11,317.13
Indiana		13,215.30			13,215.30
Kansas		4,485.37			4,485.37
Louisiana	28.28				28.28
Minnesota	1.53	4,141.30			4,142.83
New York		282.97	31.94		314.91
North Dakota		4,083.14			4,083.14
Rhode Island		6,971.23			6,971.23
Washington		2,416.57			2,416.57
West Virginia		19.74	17.22		36.96
Hawaii	53.73	138.69	3.68		196.10
Puerto Rico	497.71				497.71
Total	584.45	95,314.74	79.92	100.57	96,079.68

TABLE 13.—*Expenditures of funds from all sources for cooperative agricultural extension work in States, Alaska, Hawaii, and Puerto Rico for the year ended June 30, 1938, by sources of funds, and totals for 1933–37*

State or Territory	Grand total	Total Federal funds	Total within the States	Funds from Federal sources					Funds from within States		
				U. S. Department of Agriculture		Clarke-McNary	Smith-Lever supplementary and Bankhead-Jones	Capper-Ketcham	Additional cooperative	State and college	County	Farmers' organizations, etc.
				Farmers' cooperative demonstrations	Other							
Alabama	$1,020,014.85	$590,941.38	$429,073.47			$1,620.00	$551,720.77	$37,600.61		$157,090.21	$269,247.77	$2,735.49
Arizona	172,346.48	116,961.84	55,384.64				85,117.85	22,643.99	$9,200.00	25,460.70	29,454.98	468.96
Arkansas	846,271.33	537,155.08	309,116.25				493,537.06	33,618.02	10,000.00	265,000.00	44,116.25	
California	924,187.69	391,235.94	532,951.75			1,620.00	350,581.03	34,034.91	5,000.00	324,079.97	208,871.78	
Colorado	351,403.18	213,170.25	138,232.93			900.00	160,196.10	24,774.15	27,300.00	70,930.74	67,302.19	
Connecticut	313,869.31	130,692.71	183,176.60			1,020.00	98,703.55	24,369.73	6,599.43	120,371.07	42,500.00	20,305.53
Delaware	91,591.72	72,976.06	18,615.66				51,909.70	21,066.36		17,736.56	879.10	
Florida	414,601.42	219,399.72	195,201.70				176,543.98	26,555.74	16,300.00	82,201.69	113,000.01	
Georgia	1,008,443.48	685,077.88	323,365.60			1,620.00	630,829.73	38,628.15	14,000.00	88,291.86	235,073.74	
Idaho	266,134.72	155,802.28	110,332.44			1,620.00	114,162.46	22,919.82	17,100.00	58,795.05	51,537.39	
Illinois	1,105,929.10	542,295.95	563,633.15			1,620.00	494,309.74	38,460.78	7,905.43	143,387.66	7,953.42	412,292.07
Indiana	960,973.12	433,383.05	527,590.07			1,620.00	387,409.38	33,349.72	11,003.95	230,953.76	236,263.08	60,373.23
Iowa	1,137,260.54	497,062.24	640,198.30			1,620.00	453,638.75	33,803.49	8,000.00	219,659.07	314,168.71	106,370.52
Kansas	918,276.23	385,880.67	532,395.56			1,020.81	338,457.14	30,652.72	15,750.00	103,767.20	320,645.98	107,982.38
Kentucky	815,872.24	578,385.75	237,486.49				541,584.78	36,800.97		120,000.00	117,257.70	228.79
Louisiana	718,608.84	432,252.78	286,356.06			1,620.00	389,898.32	31,734.46	9,000.00	195,785.06	90,571.00	
Maine	241,087.73	156,011.15	85,076.58				123,607.08	24,404.07	8,000.00	51,637.64	28,236.15	5,202.79
Maryland	465,696.39	196,899.04	268,797.35			1,617.48	159,604.95	26,076.61	9,600.00	179,092.35	67,391.50	22,313.50
Massachusetts	480,396.83	138,782.77	341,614.06			1,617.00	104,295.92	23,869.85	9,000.00	110,676.00	230,938.06	
Michigan	790,385.10	436,306.33	354,078.77			1,620.00	400,433.07	34,253.26		218,678.77	135,400.00	
Minnesota	783,498.10	444,048.17	339,449.93			1,620.00	408,339.51	32,088.66	2,000.00	159,325.62	170,503.87	9,620.44
Mississippi	981,184.08	620,448.27	360,735.81			1,620.00	583,365.34	35,462.93		107,322.15	246,636.53	6,777.13
Missouri	891,627.85	565,568.10	326,059.75				519,186.47	36,381.63	10,000.00	112,212.92	139,271.20	74,575.63
Montana	356,446.10	175,471.75	180,974.35			799.92	122,672.18	23,299.65	28,700.00	51,104.35	129,870.00	
Nebraska	591,241.78	345,264.71	245,977.07			1,620.00	283,591.60	28,253.11	31,800.00	109,013.29	100,067.61	36,896.17
Nevada	127,304.24	73,107.77	54,196.47				39,984.06	20,523.71	12,600.00	23,050.72	31,145.75	
New Hampshire	226,746.09	94,774.24	131,971.85			1,620.00	65,975.52	21,778.72	5,400.00	73,523.51	58,448.34	
New Jersey	419,792.10	172,702.26	247,089.84			1,620.00	132,385.22	26,497.04	12,200.00	88,571.56	155,772.61	2,745.67
New Mexico	277,079.48	142,417.10	134,662.38				105,488.24	22,928.86	14,000.00	64,465.78	68,358.84	1,837.76
New York	1,735,221.55	478,497.61	1,256,723.94			1,620.00	429,490.02	39,087.59	8,300.00	530,321.80	705,906.51	20,495.63
North Carolina	1,184,558.35	759,299.43	425,258.92			1,620.00	715,836.35	41,843.08		106,096.92	319,162.00	
North Dakota	368,457.89	244,619.74	123,838.15			832.50	194,535.31	25,251.93	24,000.00	14,882.30	108,955.85	
Ohio	1,012,905.74	564,095.40	448,810.34			1,440.00	522,858.38	39,797.02		222,520.03	226,290.31	

Oklahoma	871,649.50	519,322.86	352,326.64				474,753.96	34,568.90	10,000.00	283,326.64	69,000.00	
Oregon	472,503.89	186,845.64	285,658.25				138,051.48	24,294.16	24,500.00	165,151.97	111,581.43	8,924.85
Pennsylvania	1,036,133.43	616,186.90	419,946.53			1,260.00	563,759.93	48,666.97	2,500.00	279,946.53	140,000.00	
Rhode Island	74,634.34	53,094.31	21,540.03				32,612.48	20,481.83		5,046.77	14,993.26	1,500.00
South Carolina	626,277.83	457,933.95	168,343.88				424,277.58	32,656.37	1,000.00	142,049.99	26,293.89	
South Dakota	357,130.57	261,171.17	95,959.40				196,021.04	25,200.13	39,950.00	45,792.13	50,167.27	
Tennessee	851,542.56	589,918.40	261,624.16			1,620.00	544,381.60	35,916.80	8,000.00	113,000.00	148,624.16	
Texas	1,883,668.48	1,098,576.21	785,092.27			1,620.00	1,035,165.81	51,790.40	10,000.00	264,727.62	508,000.61	12,364.04
Utah	197,745.44	122,052.95	75,692.49			1,080.00	86,037.38	22,235.57	12,700.00	39,500.49	36,192.00	
Vermont	216,320.64	114,291.29	102,029.35			1,620.00	85,142.55	22,228.74	5,300.00	53,000.00	42,076.43	6,952.92
Virginia	846,552.81	511,785.84	334,766.97			1,620.00	458,773.62	35,142.22	16,250.00	200,056.89	129,155.40	5,554.68
Washington	315,815.94	216,114.41	129,701.53				179,032.36	26,282.05	10,800.00	35,443.85	94,257.68	
West Virginia	487,908.20	310,277.89	177,630.31			1,620.00	274,721.60	31,436.29	2,500.00	144,469.29	32,561.02	600.00
Wisconsin	739,124.17	449,865.03	289,259.14			1,620.00	415,426.93	32,818.10		102,829.11	186,430.03	
Wyoming	183,736.93	111,003.71	72,733.22			1,260.00	65,675.03	21,438.68	22,630.00	38,248.56	34,484.66	
Alaska	23,790.09	18,918.00	4,872.09				13,918.00	5,000.00		4,872.09		
Hawaii	141,011.56	118,598.21	22,413.35				96,646.68	21,951.53		22,413.35		
Puerto Rico	237,294.38	96,188.29	141,106.09			1,617.00	94,571.29			141,106.09		
Total:												
1938	31,592,254.41	17,443,132.48	14,149,121.93			50,104.71	15,409,218.88	1,484,920.08	498,888.81	6,526,987.68	6,695,016.07	927,118.18
1937	30,033,606.59	17,030,093.32	13,003,513.27	$97,689.09		49,701.50	14,660,842.68	1,479,691.65	742,168.40	5,870,476.76	6,330,977.27	802,059.24
1936	28,299,905.64	16,190,624.41	12,109,281.23	179,708.02		48,323.51	13,502,153.16	1,479,971.78	980,467.94	5,220,032.99	5,887,700.67	1,001,547.57
1935	20,440,902.01	8,945,153.85	11,495,748.16	251,187.12		43,981.94	6,196,581.60	1,472,568.37	980,834.82	5,089,445.11	5,457,263.66	949,039.39
1934	19,844,167.34	9,216,781.45	10,627,385.89	725,094.48	$32,014.14	44,754.27	5,994,193.65	1,446,597.52	974,127.39	4,778,604.71	5,020,594.52	828,186.66
1933	21,976,841.08	9,410,053.31	12,566,787.77	865,635.74	38,839.45	60,370.93	6,039,834.67	1,458,159.68	947,212.84	6,146,294.51	5,623,467.93	797,025.33

TABLE 14.—*Total expenditures of funds from all sources for cooperative agricultural extension work in States, Alaska, Hawaii, and Puerto Rico, for the year ended June 30, 1938, by items of expense, and totals for 1933–37*

State	Total appropriation	Personal services—salaries and labor	Printing, binding, and cuts for publications	Supplies and materials	Communication service	Transportation of things	Heat, light, water, and power	Equipment	Travel expenses	Miscellaneous
Alabama	$1,020,014.85	$845,857.03	$14,534.38	$38,294.80	$5,588.08	$2,386.06	$748.62	$53,891.72	$55,372.67	$3,341.49
Arizona	172,346.48	125,963.81	1,469.64	5,175.27	2,731.82	305.51	496.05	3,354.95	25,825.77	7,023.66
Arkansas	816,271.33	680,941.64	12,693.21	19,037.44	4,915.10	1,030.55	496.21	11,892.62	111,634.88	3,629.68
California	924,187.69	741,557.94		31,227.29	13,313.63	782.51	587.83	16,257.53	113,664.28	6,796.68
Colorado	351,403.18	249,031.29	4,399.45	16,437.17	7,740.51	1,146.80	35.07	2,554.78	69,057.16	1,000.95
Connecticut	313,869.31	243,686.01	3,530.70	10,722.28	7,658.94	239.08	63.79	4,249.13	35,102.51	8,616.87
Delaware	91,591.72	67,589.36	2,346.92	4,147.83	1,885.63	36.56	95.01	2,186.51	12,522.34	781.56
Florida	414,601.42	365,935.47	6,849.68	7,844.85	948.29	124.65	148.49	1,955.80	29,730.31	1,063.88
Georgia	1,008,443.48	916,623.72	7,183.94	19,934.05	5,337.47	440.89	2,196.84	4,735.11	51,812.52	178.94
Idaho	266,134.72	193,202.33	1,996.85	8,575.46	5,384.84	606.90	95.28	2,830.04	48,767.14	4,675.88
Illinois	1,105,929.10	766,993.96	15,687.38	56,561.80	22,202.21	1,712.95	12,200.24	32,827.99	107,588.48	90,064.09
Indiana	960,973.12	682,555.51	5,649.44	31,332.69	6,665.37	751.98	936.94	17,075.25	121,778.57	94,227.37
Iowa	1,137,260.54	815,103.59	37,556.63	51,837.52	33,724.87	2,023.88	19,388.87	20,087.46	155,171.80	2,365.92
Kansas	918,276.23	628,001.27	1,532.48	41,718.44	25,401.77	3,243.39	6,004.19	37,801.15	106,695.30	67,878.24
Kentucky	815,872.24	717,161.13	8,367.61	8,794.05	1,785.35	276.07	1,800.00	458.34	76,565.53	664.16
Louisiana	718,608.84	618,050.42	4,378.66	8,416.68	2,989.25	531.95	1,200.00	10,609.97	68,738.82	3,693.09
Maine	241,087.73	174,686.46	3,054.73	10,342.34	5,538.85	569.19	1,485.27	2,809.48	41,706.56	894.85
Maryland	465,696.39	329,014.09	3,592.96	18,585.38	4,665.17	588.45	906.03	4,165.56	76,998.59	27,180.16
Massachusetts	480,396.83	370,235.87	3,647.81	7,942.40	2,041.40	256.59	29,804.52	1,729.68	63,436.87	1,301.69
Michigan	790,385.10	522,912.29	11,203.52	21,888.45	3,402.61	530.97		2,325.90	225,624.27	2,497.09
Minnesota	783,498.10	583,972.01	9,229.81	31,881.73	10,473.70	1,407.40	413.36	5,385.94	137,485.53	3,248.62
Mississippi	981,184.08	876,352.55	12,852.17	20,062.92	3,291.15	943.52	1,770.65	6,983.44	54,111.65	4,816.03
Missouri	891,627.85	708,648.80	8,506.14	32,851.69	12,403.79	813.62	1,013.80	10,731.27	110,013.60	6,645.14
Montana	356,446.10	265,977.71	5,453.55	22,638.85	1,571.52	574.98	1,127.95	2,789.09	56,308.00	4.45
Nebraska	591,241.78	452,260.40	4,687.99	18,243.91	9,662.48	1,374.36	1,543.11	3,200.06	85,262.93	15,006.54
Nevada	127,304.24	88,798.72	268.30	6,612.52	4,292.77	237.73	8.00	6,912.54	17,261.52	2,912.14
New Hampshire	226,746.09	158,517.70	4,255.06	10,183.44	4,619.81	527.38	700.00	4,111.09	38,808.18	5,023.43
New Jersey	419,792.10	345,869.00	2,159.08	12,743.40	7,895.37	83.58	1,362.67	11,803.84	32,526.57	5,348.59
New Mexico	277,079.48	181,936.02	2,486.13	7,700.56	4,028.80	352.79	618.00	6,379.25	65,309.02	8,268.91
New York	1,735,221.55	1,160,257.44	68,086.46	78,412.49	47,338.01	693.54	51,496.73	65,344.00	194,642.54	68,950.34
North Carolina	1,184,558.35	902,167.82	4,769.39	26,077.81	11,181.72	606.45	10,423.50	5,057.63	214,344.72	9,929.31
North Dakota	368,457.89	275,433.13	6,607.32	8,861.14	4,392.45	803.20	590.66	4,433.26	66,457.76	878.97
Ohio	1,012,905.74	783,888.13	17,688.88	30,856.78	14,436.58	965.85	192.36	10,287.33	149,017.21	5,572.62
Oklahoma	871,649.50	736,864.18	5,093.03	30,677.49	5,144.97	1,089.76	2,000.60	8,652.96	80,959.94	1,166.57
Oregon	472,503.89	356,800.58	2,625.72	23,006.93	9,141.74	833.44	591.49	12,926.04	61,181.71	5,396.24
Pennsylvania	1,036,133.43	721,308.91	6,160.54	15,352.59	8,987.54	266.84	1,445.85	3,840.09	184,104.05	94,667.02
Rhode Island	74,634.34	54,674.17	469.56	1,321.48	1,279.87	25.97		1,322.86	7,367.67	8,172.76
South Carolina	626,277.83	491,247.54	4,614.93	10,190.22	7,167.36	474.84	76.10	17,963.00	88,876.04	5,667.80
South Dakota	357,130.57	276,070.21	4,834.15	10,234.72	5,086.91	553.11		2,092.70	57,721.93	536.84
Tennessee	851,542.56	758,869.19	4,514.73	16,238.24	7,757.08	852.08	1,720.39	3,325.56	44,043.24	14,222.05

Texas	1,883,668.48	1,593,207.20	17,594.09	16,541.36	8,099.87	177.14	2,140.83	2,683.50	242,642.23	582.26
Utah	197,745.44	153,721.95	246.45	3,617.69	2,146.39	52.77		601.26	37,022.29	336.64
Vermont	216,320.64	153,277.29	2,002.46	13,061.80	3,099.44	179.43	783.78	4,503.33	34,487.95	4,925.16
Virginia	846,552.81	699,111.10	10,800.81	16,794.90	4,967.17	472.54	2,104.93	3,877.77	103,460.19	4,963.40
Washington	345,815.94	261,343.23	8,842.96	13,631.10	3,162.78		1,519.07	10,202.26	45,775.29	1,339.25
West Virginia	487,908.20	429.853.93	5,309.41	9,758.12	2,166.20	205.06	1,821.83	4,415.95	30,436.00	3,941.70
Wisconsin	739,124.17	590,259.55	8,114.18	29,530.86	3,410.39			1,209.26	106,157.04	442.89
Wyoming	183,736.93	135,358.95	1,000.00	6,051.96	1,132.57	550.78		1,449.53	38,189.14	4.00
Alaska	23,790.09	17,197.51		910.28	87.63	17.57		537.38	4,886.72	153.00
Hawaii	141,011.56	113,856.47	643.87	4,134.12	979.89	303.04	10.84	3,592.33	16,718.77	772.23
Puerto Rico	237,294.38	159,704.94	2,016.10	10,212.66	2,952.00	774.25	778.39	3,772.35	44,281.19	12,802.50
Total:										
1938	31,592,254.41	24,541,909.52	381,609.26	957,209.95	376,369.11	35,317.02	163,425.07	464,185.84	4,047,654.99	624,573.65
1937	30,033,606.59	23,253,403.16	369,859.76	866,206.25	369,494.61	31,852.74	120,211.88	443,729.21	4,028,239.62	550,609.36
1936	28,299,905.64	21,332,240.03	393,391.87	937,710.89	405,600.53	45,026.22	118,201.59	728,562.09	3,734,661.25	604,511.17
1935	20,440,902.01	15,215,545.45	261,763.38	752,735.57	375,656.88	35,447.46	114,896.41	397,970.68	2,818,396.37	468,489.81
1934	19,844,167.34	15,301,148.50	213,666.81	634,972.02	328,366.83	34,349.80	90,407.33	302,634.80	2,488,269.24	450,352.01
1933	21,976,841.08	17,270,232.51	308,498.89	590,488.01	297,751.47	32,107.68	87,879.83	171,009.08	2,521,981.83	696,891.78

TABLE 15.—*Expenditures of funds from all sources for cooperative agricultural extension work in States, Alaska, Hawaii, and Puerto Rico for the year ended June 30, 1938, by projects, and totals for 1933–37*

State	Total	Administration	Printing and distribution of publications	County agent work	Home demonstration work	Boys' and girls' club work	Home economics specialists	Extension schools	Animal husbandry	Poultry	Dairying	Animal diseases	Agronomy	Foods and nutrition
Alabama	$1,020,014.85	$23,807.94	$14,522.98	$551,699.36	$308,134.49	$23,124.91		$3,918.91	$12,795.75	$7,243.20			$12,175.39	$7,822.14
Arizona	172,346.48	14,161.14	1,466.50	88,134.98	28,119.61	5,641.94			608.39	2,855.99	$2,855.99		3,986.95	
Arkansas	846,271.33	31,239.42	15,127.80	379,571.49	317,792.81	10,524.91		5,580.26	4,625.22	4,281.56	4,358.82		7,441.99	4,388.84
California	924,187.69	15,586.75		614,898.12	158,577.39	16,621.59		7,738.00	4,702.53	4,474.02	8,999.54			2,999.97
Colorado	351,403.18	22,402.48	5,762.28	191,968.32	46,100.86	9,720.95			4,814.75	4,345.57	6,458.46	$2,954.26	10,377.88	3,755.68
Connecticut	313,869.31	13,458.77	4,061.86	71,914.49	38,570.43	65,880.53	$3,844.97	1,660.33	2,807.88	13,607.52	12,671.72		9,060.67	4,193.26
Delaware	91,591.72	9,841.77	2,427.55	20,471.29	16,674.85	19,837.54				5,051.53				1,963.70
Florida	414,601.42	11,180.73	6,717.00	185,518.17	134,524.69	6,595.24		367.04	4,264.95	8,791.74	3,964.94			4,841.30
Georgia	1,008,443.48	60,979.39	9,133.87	601,841.07	220,268.19	18,333.83			8,204.95	3,558.02	3,804.75		7,733.13	7,102.41
Idaho	266,134.72	11,945.06	3,948.49	149,592.29	29,625.82	7,101.59		310.54	6,065.75	5,731.18	6,458.30		14,045.76	
Illinois	1,105,929.10	60,676.09	16,576.12	624,409.09	206,599.53	41,771.93	6,984.30		11,933.85	4,536.00	13,456.80		21,753.76	6,454.38
Indiana	960,973.12	33,463.63	5,767.87	584,293.47	104,000.83	48,621.66		29,617.56	18,631.71	9,777.14	13,733.78		15,810.45	6,372.69
Iowa	1,137,260.54	76,631.82	19,210.42	571,798.00	111,259.48	97,856.61			11,825.45	7,944.78	43,863.22	5,405.11	15,016.71	8,488.59
Kansas	918,276,23	31,406.25	2,363.71	533,078.28	130,233.87	36,030.19	3,161.27	17,596.10	9,803.91	8,947.27	9,626.55	4,301.25	14,818.38	6,044.52
Kentucky	815,872.24	23,078.24	11,513.31	480,978.74	136,598.61	41,108.89		778.39	14,157.93	11,216.93	7,704.40	3,585.39	21,012.85	7,629.67
Louisiana	718,608.84	33,024.39	5,373.47	347,435.64	199,539.76	18,627.16			9,367.37	4,928.85	7,427.45		7,721.28	7,897.55
Maine	241,087.73	21,973.77	3,054.73	72,853.48	53,853.91	29,090.52				4,201.46	7,539.50		6,061.33	3,243.05
Maryland	465,696.39	33,521.90	5,286.54	125,376.27	101,229.01	16,733.73		11,337.22	8,547.88	11,328.49	12,572.02		8,427.81	3,559.89
Massachusetts	480,396.83	14,411.93	6,571.25	115,260.19	88,947.64	126,593.07		2,973.74	5,096.74	6,075.33	26.72		5,931.60	5,390.82
Michigan	790,385.10	18,517.60	12,276.65	332,230.22	74,966.64	115,104.40		1,010.14	11,299.96	13,627.41	24,177.27	5,578.62	39,532.42	4,069.89
Minnesota	783,498.10	35,322.57	12,578.36	432,567.08	72,244.84	106,854.02			10,186.72	4,121.59	20,397.18	4,692.65	13,140.38	6,674.78
Mississippi	981,184.08	62,885.51	12,852.17	509,083.88	241,531.87	30,276.02			9,580.68	7,369.70	8,406.57		7,408.67	8,736.37
Missouri	891,627.85	18,744.57	11,091.17	560,577.84	150,151.58	19,305.61		973.43	9,697.17	8,266.96	10,392.98	4,714.22	18,522.98	7,278.56
Montana	356,446.10	19,033.78	5,453.55	205,459.18	51,070.03	8,856.13		187.53	4,218.70	5,141.77	3,880.10	1,089.96	5,727.77	4,406.05
Nebraska	591,241.78	17,733.29	8,147.06	345,589.31	64,936.68	22,226.07			10,041.52	9,431.50	8,663.06		13,491.02	7,470.52
Nevada	127,304.24	14,835.45	748.57	68,171.54	27,715.91									
New Hampshire	226,746.09	20,983.04	3,750.02	48,280.40	39,241.03	57,313.98		942.88		6,997.78	4,382.38		3,655.41	3,180.08
New Jersey	419,792.10	14,575.57	2,435.64	135,024.48	69,535.32	81,633.19				10,901.39	11,973.81		9,800.42	5,853.98
New Mexico	277,079.48	15,462.82	2,670.63	145,687.35	62,086.55	5,812.46			5,137.47	4,204.55	5,840.51		4,160.68	
New York	1,735,221.55	128,289.28	68,086.46	507,212.34	285,934.11	279,619.21		48,784.40	523.74	45,444.49	60,465.57		29,133.12	24,031.58
North Carolina	1,184,558.35	33,887.43	13,854.13	713,263.45	249,302.64	12,840.54	2,334.07		10,147.71	12,993.67	20,295.43		14,876.67	6,498.46
North Dakota	368,457.89	11,972.94	7,774.37	212,983.07	32,585.35	21,283.70			7,540.81	6,721.56			4,754.28	6,467.67
Ohio	1,012,905.74	38,605.73	22,353.59	507,826.43	138,102.83	44,057,12		31,866.22	26,264.57	13,423.41	3,390.72		30,587.70	7,235.71
Oklahoma	871,649.50	49,581.20	13,027.32	346,087.95	300,522.99	24,684.02			10,396.98	10,214.22	9,724.80		12,940.35	7,973.43
Oregon	472,503.89	30,428.01	3,748.16	229,879.12	46,711.88	65,437.55			6,102.47	3,629.62	6,267.59		13,767.80	3,481.57
Pennsylvania	1,036,133.43	66,246.36	6,018.12	434,633.56	236,637.18	38,265.40			18,320.44	18,813.10	33,920.06		26,077.00	6,347.21
Rhode Island	74,634.34	3,803.41	343.25	15,620.36	14,126.05	18,555.56			2,301.75	3,727.01			2,042.99	2,542.37
South Carolina	626,277.83	37,275.49	6,933.91	300,540.77	158,653.58	11,865.24			8,635.76	7,107.64	9,064.12		7,182.31	3,857.96
South Dakota	357,130.57	15,601.25	7,255.82	196,938.23	48,033.54	24,048.34			6,523.82	3,243.27	4,711.72	4,237.14	6,384.64	4,180.90

Tennessee	851,542.56	38,239.19	7,001.94	428,207.34	245,416.10	11,701.82	3,633.95	4,298.99	17,747.52	5,501.80	8,526.82		10,509.17	4,128.64	
Texas	1,883,668.48	65,849.88	28,653.59	989,011.32	611,941.97	9,172.38			22,924.27	6,029.84	12,336.49		15,765.24	8,225.03	
Utah	197,745.44	21,094.04	246.45	98,255.23	32,883.27	6,486.89			3,749.55	3,793.68	5,576.42		3,667.91	3,669.37	
Vermont	216,320.64	27,453.89	2,489.05	51,424.31	43,442.74	50,571.55				3,869.73	4,871.48		3,288.01	3,524.32	
Virginia	846,552.81	34,142.82	14,956.33	492,681.98	157,699.35	8,643.77			11,605.13	11,222.76	18,223.60		11,480.94	3,921.34	
Washington	345,815.94	23,577.14	11,152.14	200,740.07	40,037.78	18,069.33			4,025.58	4,563.99	4,069.28		4,039.10	3,765.86	
West Virginia	487,908.20	24,526.71	9,106.91	204,467.42	91,566.75	82,065.29			8,735.93	5,656.32	6,474.57		4,148.18	3,690.86	
Wisconsin	739,124.17	23,209.12	15,982.23	314,827.79	65,285.25	37,276.84			25,086.96	11,364.89	41,896.83		41,203.78	11,720.14	
Wyoming	183,736.93	14,881.47	1,000.00	95,068.44	30,093.20	11,636.86			2,135.12	3,862.15	1,577.11		6,582.98	3,924.10	
Alaska	23,790.09	2,102.02		7,137.32	10,202.74										
Hawaii	141,011.56	13,060.64	643.87	49,923.04	49,724.83				4,436.12	4,436.11			5,201.15		
Puerto Rico	237,294.38	27,491.10	2,016.10	101,161.82	34,150.97	3,583.12			9,520.23				3,393.07		
Total:															
1938	31,592,254.41	1,512,207.79	453,533.31	15,591,655.38	6,207,187.33	1,867,063.20	19,958.56	169,941.68	405,141.69	384,578.49	515,029.43	36,658.60	553,842.08	259,005.21	
1937	30,033,606.59	1,434,292.51	448,470.81	14,880,970.38	5,718,624.31	1,842,227.68	43,695.99	173,572.96	382,133.57	367,082.95	504,080.92	41,038.94	553,898.85	256,408.74	
1936	28,299,906.64	1,595,504.83	467,762.24	14,320,269.28	5,051,403.27	1,692,015.58	40,970.45	159,712.80	423,769.99	334,575.81	407,046.17	43,475.43	505,716.36	229,906.64	
1935	20,440,902.01	1,191,666.06	308,231.36	9,559,843.54	3,976,205.12	1,472,033.30	25,107.99	153,674.93	289,178.87	302,720.98	334,769.46	39,030.57	329,667.79	192,418.13	
1934	19,844,167.34	1,089,134.54	258,509.98	9,610,515.68	3,675,904.82	1,323,486.65	24,794.36	155,446.13	315,866.16	305,912.64	334,622.23	37,638.76	335,180.85	181,941.20	
1933	21,976,841.08	1,273,621.23	328,555.12	10,264,949.45	4,048,793.31	1,524,012.10	30,659.07	206,836.46	382,261.69	351,338.12	378,878.59	42,040.07	384,245.28	198,934.40	

TABLE 15.—*Expenditures of funds from all sources for cooperative agricultural extension work in States, Alaska, Hawaii, and Puerto Rico for the year ended June 30, 1938, by projects, and totals for 1933–1937*—Continued

State	Child care and training	Clothing	Home management	Horticulture	Botany and plant pathology	Entomology, apiculture, ornithology	Soil conservation	Forestry	Agricultural engineering	Rural organization	Agricultural economics			Exhibits and fairs	Publicity	Miscellaneous specialists
											Farm management	Marketing	General			
Alabama		$4,585.18	$4,482.23	$7,277.09		$3,156.38		$4,552.22	$13,571.98		$300.00		$7,040.79		$8,672.77	$1,131.14
Arizona		3,664.51	4,635.15	4,211.54						$5,179.97			4,034.07		2,789.75	
Arkansas		3,492.88	6,409.84	4,668.17				6,115.07	5,067.25	7,752.92	4,669.12	$6,357.18	2,991.20		13,814.58	
California		4,244.17	3,890.51	5,434.32	$3,891.92			5,036.97	9,701.00		21,261.70	5,721.49	5,044.60	$8,588.00		16,775.10
Colorado	$3,554.98	3,436.37	3,378.54	1,089.21	3,717.02	6,375.15		3,309.98	3,419.70				3,328.75		10,763.61	368.38
Connecticut		4,310.51	4,295.77	12,430.59		1,151.70	$3,039.95	6,241.47	4,128.33	968.44	12,138.55	11,408.97		1,875.75	9,297.38	849.47
Delaware			3,589.35		333.09	2,868.11							3,789.23		4,743.71	
Florida		2,700.00	3,217.20	1,564.47	1,564.47	1,564.46					5,044.91	5,044.91	5,044.91		5,975.00	16,115.29
Georgia		3,440.33	6,884.30	7,644.42	3,112.08			5,321.38	9,223.98	3,009.95	7,634.38	15,268.78			5,944.27	
Idaho		4,021.79		5,208.95		2,830.79		4,724.96					8,892.90		93.30	5,537.25
Illinois	3,126.49	5,778.50	9,942.34	11,855.43				7,270.15	8,710.92		12,847.22	12,847.22	6,423.60		11,975.38	
Indiana		6,138.29	6,470.34	16,926.28	8,801.01	3,515.89		8,673.30	9,498.05		16,698.41	8,260.71			5,900.05	
Iowa	3,043.37	8,693.10	14,575.57	22,066.84	12,957.76	11,518.37		3,583.91	7,479.10	9,501.87	17,164.13	23,129.06	5,074.14	2,986.67	24,375.05	1,811.41
Kansas		5,948.32	10,947.24	8,717.65	3,849.78	4,320.38		2,511.14	18,766.82		13,511.65	11,791.11	5,139.82		25,360.77	
Kentucky		7,968.83	6,713.97	11,319.37					8,216.76	1,400.40	6,594.54	6,639.86			7,555.16	
Louisiana			4,557.31	14,727.52		2,275.35		3,296.15	8,399.66	12,094.98		2,088.71	19,909.22	4,918.65	4,998.37	
Maine		3,308.31	3,460.29	3,030.66				3,564.91	3,685.62		6,124.91	9,241.07			6,800.21	
Maryland		3,521.88	5,378.26	13,865.31	9,900.94	48,198.94	514.61	3,579.65	6,198.34	1,390.47	4,422.59	21,384.47			9,417.17	
Massachusetts	5,256.32	5,509.13	10,233.27	19,277.93	4,878.35			4,604.84	5,520.00	10,159.43	13,032.09	13,032.10	1,889.77		9,724.55	
Michigan	3,736.97	7,697.01	15,165.35	22,688.56	2,653.98	4,599.67		5,231.41	12,734.52		16,233.49	26,563.64			18,111.83	2,577.45
Minnesota	3,390.72	6,201.22	8,185.77	3,611.96	4,214.38	3,269.37		5,087.24	103.21		12,282.74	10,800.99			7,570.33	
Mississippi		4,150.86	4,193.22	9,396.04				4,929.76	16,113.48	13,356.25	4,758.53	19,034.10			7,120.40	
Missouri		7,483.73	8,461.50	7,597.74		4,480.33	5,677.37	4,515.78	8,499.22		7,633.89	11,250.91			6,310.31	
Montana		4,064.39	4,338.76	3,380.49	957.17	542.68	1,886.19	1,599.92	5,893.29		3,292.47		8,122.66		4,254.12	3,589.41
Nebraska		2,573.28	12,179.99	6,451.72		4,691.48		7,929.26	14,078.33	7,435.91	8,382.88	9,546.44			10,242.46	
Nevada							2,436.35						11,257.83		2,138.59	
N. Hampshire		3,144.37	3,704.93	7,839.41				7,799.17	2,138.43	5,492.57	3,668.23	4,231.98				
New Jersey	7,057.24	4,752.37	527.44	23,559.11				5,552.10	5,632.81	3,346.43	5,368.36	10,534.30			11,728.14	
New Mexico			4,562.73	2,485.88			1,462.50		3,553.52				5,550.33		8,401.50	
New York	16,053.58	24,881.64	19,107.17	35,189.18	20,514.70	17,385.22		8,321.31	22,460.13	13,745.94	23,150.95	23,150.96			33,736.47	
North Carolina		6,557.97	7,348.85	10,754.21	4,811.69	7,805.61		9,572.52	18,681.92		7,450.15	11,261.23			10,020.00	
North Dakota	3,581.86	7,541.68	6,203.12	3,167.02	2,779.18	2,779.18	2,066.70	1,665.00	5,780.53	989.02	2,497.81	4,758.36			12,564.68	
Ohio	4,210.98	8,330.01	12,323.74	24,427.33	3,550.92	8,578.71		4,529.32	16,317.26	6,253.25	22,916.65	15,711.05			22,042.49	
Oklahoma	4,091.17	4,902.12	7,232.34	12,592.12		9,956.01			12,583.00		9,402.88	7,907.24	13,099.94		4,729.42	
Oregon	4,294.25	3,324.56	3,376.98	5,984.63					4,114.80	8,898.29	14,060.43	5,980.79		3,444.60	1,904.41	7,666.38
Pennsylvania		6,685.87	8,365.60	24,788.38	22,462.85	23,840.04		9,906.60	9,321.83	5,346.16	9,461.10	21,384.65			9,291.92	
Rhode Island		1,437.61		3,035.36						3,114.15			3,101.77		882.70	
South Carolina		2,601.21	2,893.83	8,913.63		7,087.36		523.65	8,910.00	2,313.51	11,421.90	17,700.02		6,308.63	6,487.31	

South Dakota		3,828.55	3,780.20	1,655.91		1,655.91	1,223.27	4,863.06	1,280.40	2,719.59	6,581.75	1,281.50		3,765.12	3,336.64		
Tennessee		4,290.79		5,166.43				3,825.40	6,779.74		28,740.43	11,703.57			6,122.92		
Texas	4,852.95	5,270.48	13,896.08	10,225.85		5,455.62		4,271.54	15,719.67	7,453.57			21,146.70		19,313.97	6,152.04	
Utah		2,592.87	6,870.42	3,640.89				2,160.00					2,210.08		848.37		
Vermont		3,969.29	3,973.27	1,548.41				3,324.90	783.47		4,626.86	4,061.53			3,097.83		
Virginia		3,276.47	4,056.42	21,601.44	3,755.67			3,773.86	13,602.08	7,685.70	3,799.47	3,799.47	11,398.40		5,225.81		
Washington		3,637.77	3,616.93	4,602.21		1,411.88			4,092.06				5,810.72		8,604.10		
West Virginia				16,186.74	2,539.26			6,425.88		9,695.33	3,905.09				8,248.82	468.14	
Wisconsin	419.65	9,262.45	7,476.70	25,672.31	9,810.13			10,932.03	9,611.80	16,416.33	14,023.25	19,281.05			28,364.64		
Wyoming		3,257.68		2,157.82				2,520.00					5,040.00				
Alaska																4,348.01	
Hawaii				4,863.90								2,907.30	5,814.60				
Puerto Rico								3,234.00							3,388.46	49,355.51	
Total:																	
1938	66,670.53	226,478.35	284,902.82	484,500.43	131,056.35	191,314.59	18,306.94	194,879.81	340,373.01	165,720.45	365,103.51	395,066.72	171,156.03	31,887.42	432,289.72	116,744.98	
1937	63,112.95	202,351.56	266,548.86	451,647.60	131,442.81	166,063.10		178,540.88	327,920.59	170,248.61	385,548.16	350,437.73	154,663.96	36,173.48	420,345.75	82,061.94	
1936	54,732.12	181,727.56	232,743.10	416,944.43	120,487.63	164,480.88		152,053.63	281,111.17	139,672.62	407,956.84	339,883.58	111,120.32	21,943.37	350,948.12	51,971.42	
1935	29,831.54	164,646.85	185,276.15	357,235.88	103,553.99	127,935.36		130,921.51	175,434.43	87,494.05	259,103.98	236,785.87	105,514.09	17,039.93	252,886.45	32,693.83	
1934	35,482.04	155,305.04	191,038.51	346,957.98	94,776.31	124,014.30		124,165.32	157,615.99	80,606.89	261,089.91	257,404.93	73,717.17	13,715.12	251,722.88	27,600.95	
1933	34,558.25	169,724.73	198,835.62	402,637.81	106,801.75	146,023.12		153,804.09	183,801.81	70,072.75	317,280.47	437,415.22	13,848.70	14,229.16	265,259.13	47,423.58	

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REPORT OF THE ADMINISTRATOR OF THE FARM SECURITY ADMINISTRATION

1938

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LETTER OF TRANSMITTAL

UNITED STATES DEPARTMENT OF AGRICULTURE
FARM SECURITY ADMINISTRATION

WASHINGTON, D. C., *October 1, 1938.*

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY:

I transmit herewith a report of the work of the Farm Security Administration for the fiscal year ended June 30, 1938.

Sincerely yours,

WILL W. ALEXANDER,
Administrator.

CONTENTS

	Page
Introduction	1
Rehabilitation	3
Farm and home planning	3
Standard rural-rehabilitation loans	4
Guidance for borrowers	4
Security of tenure	4
Medical care for low-income farm people	5
Farm-debt adjustment	5
Community and cooperative services	6
Types of community services	6
Number of applications	7
Services provided without funds	8
Progress of rural-rehabilitation clients	8
Emergency loans	10
Direct relief in the form of grants	10
Collections	10
Farm purchase for tenants	11
Loans on liberal terms	11
Distribution of funds	12
Selection of applicants and farms	12
Farm planning for owners	13
Variable payments	13
Size of loans	13
The homestead projects	15
Rural homesteads	16
Low-cost construction	18
Greenbelt communities	19
Real property control	21
Unsolved problems	22

REPORT OF THE ADMINISTRATOR OF THE FARM SECURITY ADMINISTRATION 1938

INTRODUCTION

On June 30, 1938, the Department's program of assistance toward self-support for low-income farm families, now under the direction of the Farm Security Administration, reached the end of its third fiscal year.

The year witnessed several major changes in organization. On July 22, 1937, the Bankhead-Jones Farm Tenant Act was approved by the President. This act authorized the Secretary of Agriculture to lend money to farm tenants for purchase of farms, to make rehabilitation loans to farmers for subsistence, improvement and other purposes, to develop a program of land utilization, including the retirement of submarginal land, and to complete projects begun by the Resettlement Administration and other agencies.

On September 1, 1937, the Secretary of Agriculture designated the Farm Security Administration as successor to the Resettlement Administration and assigned to it responsibility for making loans to tenants for purchase of farms, for making rehabilitation loans, and for completing projects begun by the Resettlement Administration.

Responsibility for the land-utilization program authorized by the act was assigned to the Bureau of Agricultural Economics. The Land Utilization Division of the Resettlement Administration was transferred to that Bureau to assist in administering the program.

The work of the Farm Security Administration has assumed three major phases:

1. A program of rural rehabilitation similar to that administered by its predecessor. Under this program: (a) Farmers handicapped by an uneconomic

scheme of operations and unable to obtain adequate credit from any other source may obtain assistance in planning a better system of farming, and may, in addition, obtain small loans to enable them to put the plans in operation; (b) farmers overburdened with debt are helped to negotiate voluntary adjustment with their creditors; and (c) farm families in extreme distress, and without prospect of making a crop (as in drought or flood areas), may receive small grants for the purchase of food and clothing. This program is financed through emergency-relief appropriations.

2. A farm-purchase program under which tenants, sharecroppers, and farm laborers may receive loans for purchase and improvement of farms of their own. This program was authorized by title I and related sections of title IV of the Farm Tenant Act.

3. A homestead program under which the Farm Security Administration is completing 149 farm and suburban home projects begun by its predecessor.

During the year, administration of the program of rural rehabilitation has been marked by an increasing emphasis on careful farm- and home-management planning. The place of leasing arrangements in the farm plan and the health aspects of home planning have been singled out for special attention. The farm debt adjustment service has expanded its activities further into the field of burdensome group debts—such as irrigation and drainage-district bond issues. At the end of the 1937 crop year a study was made of the progress of approximately 231,000 farm families operating for a year or more under farm- and home-management plans worked out with Farm Security Administration assistance. The results of that study were hopeful and reassuring and have indicated the soundness of the program of individual farm planning.

Administration of the program of loans to tenants for farm purchase, in its initial fiscal year, was marked by a careful approach to the new problems presented. The division created to assume responsibility for the tenant purchase program set up the machinery of administration with exacting care, guided by the previous experience of the Resettlement Administration and other agencies of the Department of Agriculture in farm selection, farm appraisal, and management procedures. It is felt that the cautious approach indicated by the Congress in its appropriation policy has been justified by the results obtained during the fiscal year.

The past year's progress toward completion of the resettlement projects has culminated in the establishment of new standards in low-cost construction of rural homes.

Detailed discussions of the year's operations will be found in subsequent sections of this report.

REHABILITATION

The purpose of the rural-rehabilitation program is to help destitute and handicapped farm families to become self-supporting and self-reliant. Its core is the farm- and home-management plan worked out with each individual family which comes to the Farm Security Administration for aid. A loan for the purchase of essential tools and livestock—a plow, a mule, seed, a few chickens, a pressure cooker, and other simple equipment—enables the family to put the plan into operation.

Obtaining farm land adequate to support a reasonable standard of living; adjustment of debts within the ability of the family to pay; improvement in terms of land tenure; and the reduction of operating costs through group use of expensive equipment are additional steps which often are necessary to carry out the rehabilitation of such families.

FARM AND HOME PLANNING

The farm and home plans of Farm Security Administration borrowers are the result of a careful adaptation of sound general principles to individual situations. When a family applies for aid, the county rehabilitation supervisor and home-management supervisor cooperate with them in analyzing their resources. On the basis of this inventory, an effort is made to ascertain what the family needs to make it self-supporting and self-reliant—whether that be more or better land, improved farming practices, more equipment, or thriftier management. Then the family works out, with the assistance of the supervisors, a plan for meeting these needs. The plans generally provide, insofar as possible, for a year's supply of home-grown vegetables, fruit, meat, poultry, eggs, and milk for the family's use; for ample pasture, forage, and grain for its livestock; and for the production of sufficient cash crops to meet operating expenses and repay the Farm Security Administration loan and other obligations.

Appropriate consideration is given to acreage allotments and benefit payments made by the Agricultural Adjustment Administration; to land use recommendations of the Bureau of Agricultural Economics; to cropping and erosion-control practices recommended by the Soil Conservation Service; and to technical services available from the Extension Service, the experiment stations, and the vocational agricultural and home economics departments of local schools.

To help the borrower make this common-sense planning an established habit, the supervisors also secure the cooperation of the family

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in keeping farm and home record books. In these books are entered week by week the family's production and consumption of farm products, and its cash income and expenditures. Analyzed at the year's end, these records are the basis for revision of plans for the new year.

STANDARD RURAL-REHABILITATION LOANS

Insofar as the farm plans call for additional materials, goods, and equipment, the Farm Security Administration will approve loans. Each member of a borrower's family is expected to know the purpose for which the money is to be used, and to cooperate in carrying out the farm- and home-management plan. Loans are made for not more than a 2-year period for household, crop, and feed needs; and for not more than a 5-year period for livestock and farm and home equipment. During the year standard rehabilitation loans totaling $35,416,257 were approved for 61,883 new borrowers. Supplemental loans, principally for crop-production purposes, were approved for 137,671 former borrowers, in the amount of $29,651,759.

GUIDANCE FOR BORROWERS

Wherever farm and home plans call for changes in management practice or the adoption of methods new to the family, the Farm Security Administration's county supervisors offer continuing counsel and technical help. For this purpose the supervisor visits the rehabilitation farmers of his area regularly, and the home-management supervisor visits the farm wives in their homes. On these visits progress and possibilities under the farm and home plan are discussed. Instruction is given the families, both on the individual farm and in group meetings, in developing farm and home plans, keeping farm family records, and also in technical phases of crop and livestock production, food production and conservation, health and sanitation, and similar subjects.

SECURITY OF TENURE

Since insecurity of occupancy may retard or defeat efforts to rehabilitate a farm family, the Farm Security Administration has a definite interest in the tenure arrangements of each applicant for a rehabilitation loan. It generally requires that the borrower have a written lease, which assures equitable tenure arrangements and reasonable security of occupancy.

During the past year a Tenure Improvement Section was established in the Rural Rehabilitation Division with the purpose of making

a careful study of the tenure systems that prevail throughout the United States and preparing suitable lease forms for use by rehabilitation clients and their landlords. With the cooperation of other agencies, it is carrying out a broad program designed to improve tenure arrangements of rehabilitation clients and of other tenant farmers.

Flexible lease forms have been prepared that are simple and understandable; that undertake to establish a mutual confidence between landlords and tenants; and that are intended to provide greater security of tenure. These are available to rehabilitation clients and other farmers through county supervisors, and are commonly used as a basis for tenure arrangements on which standard rehabilitation loans are made.

MEDICAL CARE FOR LOW-INCOME FARM PEOPLE

The health of the family necessarily has a direct and important bearing on its progress toward rehabilitation. Through more than 100 medical-service plans organized throughout the country to provide rehabilitation families with medical aid, a number of experiments in types of organization and methods of approach are being worked out that should furnish a pattern for this type of service in the future.

These activities are initiated only after State medical associations have given their approval and the cooperation of local medical associations is assured. The medical-care plan in most general use not only provides more adequate health protection for participating low-income families, but also serves as a form of insurance that buttresses the family against the financial disaster which often results from an extended illness. The improved health of families participating has had a marked effect on their economic progress, and has proved one of the best safeguards for the Government's investment in those families.

FARM-DEBT ADJUSTMENT

Functioning as part of the Rural Rehabilitation Division, farm-debt adjustment specialists especially trained in farm-credit problems work with local voluntary committees to help farm debtors and their creditors arrive at mutually beneficial agreements that will forestall litigation, wholesale foreclosure, or ill feeling.

The basis of such agreements is the normal ability of the debtor to liquidate his obligations. Each debtor is expected to meet his debts to the limit of his capacity which, in many cases, precludes the necessity of any reduction in the amount due creditors, and merely requires

a more equitable repayment plan or a reduction of interest rate. Where the burden of debt is beyond hope of repayment, adjustments in line with the ability of the debtor to pay are worked out. The ability to pay is usually increased at the same time—especially in the case of rehabilitation clients, whose farm- and home-management plans look toward an increased income through greater efficiency, proper utilization of land resources, and production of more livestock feed and food for home consumption.

Distressed farm debtors who are not clients of the Farm Security Administration receive the same consideration as those who are, although loans aiding in the adjustment may come from other sources such as the Farm Credit Administration, insurance companies, and local banks.

Debt-adjustment service is provided for groups of farmers as well as individuals. These groups include the membership of irrigation, drainage and levy districts, and similar organizations. During the past year, 16,663 individual farm-debt cases were adjusted, involving a reduction of $13,692,560 from a prior debt of $56,549,584. Group cases adjusted involved 4,472 farmers, with a reduction of $3,269,462 from a prior debt of $5,159,560.

Types of adjustment included 11,125 cases of debt reduction, 2,576 cases of debt extension, 32 cases of interest-rate reduction, and 2,930 cases of a combination of these and other methods.

COMMUNITY AND COOPERATIVE SERVICES

Substantial progress has been made during the year in the utilization of community and cooperative services as an aid to the rural-rehabilitation program.

Emphasis has been placed on providing facilities and services necessary to rehabilitate borrowers when such facilities and services cannot be economically justified on the basis of individual use only.

In addition to loans to finance the group purchase of facilities such as purebred sires, heavy farm equipment, or health or veterinary services, emphasis has also been placed on loans to individuals to finance their participation in new cooperative associations or in existing cooperatives which will aid in rehabilitation.

TYPES OF COMMUNITY SERVICES

Due to the transition in many sections from the one-crop system of agriculture to diversified farming, there has developed an increasing need for harvesting machinery, general farming equipment, and im-

proved livestock. It has proved practicable for an individual or groups of individuals to acquire such facilities for use by a group. Loans have thus been made to individuals to purchase and operate tractors, combines, plows, harrows, mowers, rakes, row binders, cultivators, grain drills, and other types of farm equipment for group use.

In promoting sound farm practices through diversification and increased production of food and livestock feed, loans have been made to establish livestock-improvement services, potato-curing houses, feed and grist mills, transportation services, sirup mills, home-canning equipment, hatcheries, and other facilities that can be used by a number of families in the same neighborhood.

Community and cooperative service loans have also been made to finance the participation of rehabilitation borrowers in grazing, veterinary, and medical and health services, which in many cases could not be obtained except through cooperative efforts.

Several significant developments have aided groups of families to obtain needed services.

For example, grazing associations were organized where farmers were interested in diversification and where large tracts of grazing land were available. These tracts are too large for the use of individual borrowers. They are leased by the group, and each member pays his share of the rental, based on the number of animals grazed.

Artificial insemination as a means of improving dairy herds has been included as an additional service in a selected number of veterinary associations. This service is being limited to groups within areas where the production of livestock is an important factor in the farm economy.

Particularly important has been the effort to provide modern equipment to enable groups of farmers to carry out soil conservation practices. Agreement among farmers to work together, as a group, in the use of approved equipment has been an important factor in the amount and quality of work done.

NUMBER OF APPLICATIONS

During the year loans were made to individuals to finance establishment, operation, or participation in 2,952 such service enterprises as have been described above, involving a total of $1,934,702.97. There were 47,310 participants in these services, approximately 90 percent of whom were rehabilitation families. These loans average $655.39 per service, or $40.89 for each active participant.

A total of 5,403 applications for community and cooperative services

have been approved in the regional offices during the 3-year period of the program. Fifty-four percent of these were approved during the year. These services have aided more than 100,000 families and have involved more than $3,134,000 in loans.

Loans have been made also to individuals to finance their participation in existing cooperatives, or directly to cooperative associations. They involved $248,750.77 and served 3,116 families.

The total of all types of community and cooperative services loans approved during the year in the regional and Washington offices is 2,990, involving $2,183,450 and serving more than 50,000 families.

SERVICES PROVIDED WITHOUT FUNDS

It is significant that many necessary facilities have also been made available through the efforts of the community and cooperative services personnel, without the necessity of loans being made for such purposes. Three hundred and sixty such services were made available to 1,692 farmers during the year.

Aside from the immediate financial benefits accruing to borrowers from the operation of community services, it is believed that this phase of the program is laying a firm foundation for further development of cooperative action in rehabilitating American agriculture. Small groups of individuals cooperating to obtain necessary facilities or services in restricted areas are gaining valuable experience in cooperative practices, which should stimulate the sound expansion of cooperative enterprises in future years.

PROGRESS OF RURAL-REHABILITATION CLIENTS

A tentative survey of the progress of standard rehabilitation borrowers as of December 31, 1937, indicated that throughout the country, except in areas suffering from drought and other catastrophes, standard rural-rehabilitation clients have increased their home food production, farm diversification, working equipment, living standards, and total net worth.

A total of 231,661 client families were surveyed. These families included 1,195,826 persons. The facts brought to light graphically illustrate some of the methods and results of the program.

Many of the families who applied for loans were cultivating acreages too small to support a sound farm enterprise. These farmers were given assistance in finding additional land or a farm of a more economic size. The average number of acres in cultivation on farms operated by borrowers at the time of acceptance on the rehabilitation

program was 80 acres; at close of the 1937 crop year it was 102.5 acres.

The 231,661 farmers studied owned only 264,377 work animals at the time of acceptance on the Farm Security program. By the end of the 1937 crop year they owned 512,390 work animals.

Of these same families, 62,334 that did not own a milk cow when they applied for a loan had acquired a milk cow by the end of 1937, and 141,716 families had increased their ownership of dairy cattle; 69,759 families that had been without hogs acquired one during the same period, and 132,437 families were feeding more hogs in the fall of 1937. Of 48,375 families that did not own poultry at time of entry into the program, 36,120 acquired flocks before the end of 1937; 147,097 families had increased their ownership of poultry.

To support this increase in livestock production, borrowers increased their acreages in feed and forage crops. At time of acceptance on the program, these farmers had a total of 4,739,784 acres planted in such crops. During the last crop year they had a total of 7,343,653 acres in feed and forage.

Better farm management has produced a marked improvement in the standard of living of many borrowers. The average production of milk for each member of the family increased from 109 to 189 quarts per year. The average weight of fresh and cured meat produced for home consumption increased from 35.2 to 67.7 pounds annually for each member of the family. Production of eggs for home consumption almost doubled.

Families participating in the program planted adequate gardens to supply the home kitchen. Between peak labor periods in the fields, they canned and preserved enough food to carry the family through the winter, without resorting to heavy cash expenditures for subsistence. After joining the program, the quantity of fruits and vegetables they canned and stored increased from 21.6 to 53 quarts per year for each member of the family. The wholesale value of products produced and consumed at home increased from approximately $121.65 per family, to an average of $254 annually.

This rise in the standard of living has been attended by an increase in the net worth of borrowers. The decrease in cash outlay for subsistence has resulted in larger expenditures for other, more lasting, betterments. The net worth of these farm families—that is, the value of furniture, clothing, supplies, live stock and equipment, minus debts—has increased $252 per family since they received loans from the Farm Security Administration. This meant an addition of more than $58,417,000 to the wealth of their communities by this group of 231,661 families.

The results of the rehabilitation program cannot be measured in

dollars alone. There are, for instance, 159,242 children in this group of families who have increased their school attendance since their parents joined in the rehabilitation program.

Of the families studied, 139,000 had improved their tenure status. Of these, 98,000 changed from a verbal to a written lease, 67,000 obtained renewable leases, 65,000 changed from sharecroppers to tenants, and 66,000 moved to better farms.

County rehabilitation supervisors reported that they knew of approximately 360,000 additional farmers who apparently were in need of Farm Security loans last year, but who could not obtain them because of lack of funds.

EMERGENCY LOANS

Emergency loans are made to low-income farm families unable to secure credit from other sources, to enable them to buy or produce feed for livestock, and to buy food for family-subsistence purposes. These loans were made in drought and flood areas where conditions did not permit the making of standard rehabilitation loans. During the year, 4,982 original emergency loans were made in the amount of $760,056. There were also made 2,028 supplemental emergency loans in the amount of $249,340.

DIRECT RELIEF IN THE FORM OF GRANTS

While there was a substantial decrease in the latter part of the year in the number of grant payments made to families in areas of drought, flood, and other catastrophes, the effects of several previous years of drought still made necessary a large grant load. These grants were made where land resources and other conditions were such that standard farm loans could not be developed, to provide needy farm families with food, clothing, and medical attention. Grant payments were approved in a total amount of $23,062,061.65. Approximately 250,000 families received such assistance at some time during the year.

COLLECTIONS

At the end of the fiscal year the number of farm Security Administration loan cases, including standard and emergency loans, totalled 649,919. The total amount of loans outstanding was $216,876,146, of which $47,877,915.34 was loaned from funds of the State rehabilitation corporations. The Administration has collected $52,625,436.05 of which $27,786,609.57 was collected during the year. In addition,

$23,545,272.64 has been collected in behalf of the State rehabilitation corporations.

The percentage of maturities collected by States ranges from 32.40 percent in the drought States of Nebraska, North Dakota, South Dakota, and Kansas, to 83.17 percent in Alabama, Georgia, Florida, and South Carolina. The amount collected has been influenced not only by agricultural conditions but often by the nature of security and the relatively short periods of maturity. Likewise, it has been influenced by local credit practices and by the laws of certain States that affect the terms of the notes and the security obtained. First consideration has been given to the progressive welfare of the borrower and a constructive collection program has been followed looking forward to the ultimate rehabilitation of the farmers to whom loans have been made. It is anticipated that at least 80 percent of all money loaned will eventually be returned to the Federal Treasury.

FARM PURCHASE FOR TENANTS

The goal of the rehabilitation program is permanent self-support for low-income families who have reached a relief or near-relief status. Through the tenant-purchase program, tenants, sharecroppers, and farm laborers, including some "graduates" from the rehabilitation program are given an opportunity to take a final step toward security through ownership of a family-size farm.

LOANS ON LIBERAL TERMS

The essence of the tenant-purchase program is a liberal loan policy, predicated on the soundness of operator ownership as an institution. A loan may be made to a farm family that owns no land for the full value of the farm it desires to buy, plus the cost of improvements. Preference is given, however, to farmers who are able to make a down payment, or who own livestock and equipment necessary to carry on farming operations. The loan bears 3-percent interest and may be retired over a period of 40 years. As security, the Government accepts a lien on the property purchased. In lieu of additional security in the form of a lien on other property, the Government accepts the purchaser's agreement to follow a sound system of farming that will conserve the soil and the value of the property. Thus, through ownership, the farmer acquires a new incentive to protect the public interest by preserving the soil. In contrast the tenant often is tempted to mine the land for all he can get out of it, neglect buildings and improvements, and move on when the value of the farm is destroyed.

DISTRIBUTION OF FUNDS

Of the $10,000,000 appropriated for tenant-purchase loans during the year, 5 percent was allocated for administrative expenses, expenses of local committees, and technical services. The remaining $9,500,000 available for loans was apportioned among the States and Territories on the basis of farm population and the prevalence of tenancy. Loans were made in a limited number of counties in each State, since an attempt to operate in all counties would have resulted in such scattered purchases that administrative costs would have risen to a prohibitive level.

The selection of counties in which loans were made was primarily the work of State farm security advisory committees. These committees, composed of local farm leaders and other persons interested in farm problems, were appointed by the Secretary of Agriculture. The counties were selected on the basis of farm population, the prevalence of tenancy, the availability of good land at reasonable prices, and other pertinent factors. Approximately 7 loans were made in each of the 333 counties recommended by State committees and designated by the Secretary of Agriculture as tenant-purchase-loan counties.

The advisory committees, in addition to recommending counties in which loans were to be made, have given the Administration invaluable assistance through their counsel on other matters of policy touching every phase of the rehabilitation, tenant-purchase, and homesteads programs.

All citizens of the designated counties, who obtain or recently had obtained most of their income from farming but who were not farm owners, were given an opportunity to apply for tenant-purchase loans. More than 38,000 such farm families filed applications during the year; in other words, there were more than 100 applications for each loan that could be made.

SELECTION OF APPLICANTS AND FARMS

As speedily as possible after the program was initiated, a committee of three local farmers in each designated county was appointed by the Secretary in accordance with provisions of the Farm Tenant Act. Upon investigation, supplemented by their own first-hand knowledge of local people and lands, these committeemen passed on both the farmers to receive loans and the farms to be purchased.

The work of these committees greatly facilitated the selection of applicants whose character, ability, and experience fitted them to become successful farm owners. The committees also were most

effective in insuring the purchase of family-sized farms large enough and sufficiently productive to enable the borrower to pay taxes and insurance, maintain the property, provide a satisfactory living, and retire the loan. Finally, they provided considerable assistance in determining that the price of the property was in keeping with its value.

With this cooperation from local committees, 1,887 loans for purchase and improvement totaling $9,225,083 received final approval by the end of the year.

FARM PLANNING FOR OWNERS

Once the loans are made, administration of the tenant-purchase program, like that of the rehabilitation program, centers on farm plans worked out with the assistance of trained personnel.

Tenant borrowers make their farm plans in much the same way as rehabilitation borrowers. One important additional element, however, enters into the planning. It is possible for the new owner to lay out his scheme of operations on a long-range basis. It is difficult, and often impossible, for a tenant with a 1-year lease to plan a sound 5-year crop rotation; but for an owner, such operations are easily feasible. Planning for progressive farm improvements likewise is simpler for the owner.

VARIABLE PAYMENTS

The Farm Tenant Act provides for repayment of tenant-purchase loans under a variable payment plan, if the borrower so desires. This plan is designed to give added security of ownership by enabling the purchaser to pay more in years of good crops or high prices, and less in years of poor crops or low prices. Under this system, the owner is protected against loss of his farm through factors beyond his control.

Payments for each year, under the variable plan, are based on the farm record book of the borrower. The payment due is calculated as a portion of the net cash income—that is, whatever is left over above operating and living expenses—earned during a crop year.

SIZE OF LOANS

Much basic information necessary for the operation of the program has been gathered during the first year.

The experience of this year has confirmed original estimates that the amount of each loan would average less than $5,000. On the basis of

the actual returns, the average loan from all funds, including the loans in Hawaii, amounted to $4,890. Only 81 loans (little more than 4 percent of the total number) have been for as much as $10,000 each and Region III reported 40 of these larger advances.[1] Since land prices in the South are comparatively low, Regions comprising States in that section are conspicuous for their relatively small average loans. The loan averages for the respective Regions and for Hawaii are listed in table 1, according to the seven lowest and the six highest averages.

TABLE 1.—*Tenant-purchase loan averages, all funds, fiscal year 1938*

Region	7 lowest averages	Region	6 highest averages
V	$3,393	X	$8,530
Hawaii	3,494	IX	7,676
VI	3,895	III	7,592
IV	4,834	VII	7,420
I	5,314	II	7,112
VIII	5,485	XI	6,801
XII	6,108		

United States average, $4,890.

The price for the farm and any necessary buildings naturally absorbs the major portion of a loan under the tenant-purchase program. Of the $9,300,216 total cost for the purchase of farms and buildings, improvements, and fees during the 1938 fiscal year, $7,685,161, or about 83 percent, went for the farm real estate, exclusive of expenditures for new construction and improvements.

Purchase prices varied widely in the different Regions; they were generally lowest, as was to be expected, in southern areas. The general average approximated $4,075. Table 2 shows the total number of farms approved for purchase during the year, together with the number of farms in seven purchase-price groups. Attention is particularly directed to the large totals for Regions V and VI in the two lowest price categories.

Further analysis of the aggregate cost of all farms for purchase from loans approved during the year discloses that $1,522,012, or about 16 percent, went into new construction and property improvements. Regions V and VI, in which land prices are relatively low, show the largest expenditure for construction of new dwellings and for

[1] The States in each Region are: Region I, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New Jersey, New York, Pennsylvania, Delaware, Maryland, and District of Columbia; Region II, Michigan, Wisconsin, and Minnesota; Region III, Missouri, Ohio, Illinois, Iowa, and Indiana; Region IV, West Virginia, Virginia, Kentucky, Tennessee, and North Carolina; Region V, South Carolina, Georgia, Alabama, and Florida; Region VI, Arkansas, Mississippi, and Louisiana; Region VII, North Dakota, South Dakota, Nebraska, and part of Kansas; Region VIII, parts of Texas and Oklahoma; Region IX, California, Nevada, Utah, and Arizona; Region X, part of Colorado, Wyoming, and Montana; Region XI, Washington, Oregon, Idaho, and Alaska; Region XII, New Mexico, and portions of Colorado, Texas, Oklahoma, and Kansas.

TABLE 2.—*Total number of farms approved for purchase from loans approved during the 1938 fiscal year, and number of farms in purchase-price groups*

Region	Total farms	Farms in purchase-price group						
		$2,500 and under	$2,501 to $3,500	$3,501 to $4,500	$4,501 to $5,500	$5,501 to $7,500	$7,501 to $10,000	Above $10,000
I	54	9	7	12	9	8	9	0
II	64	0	5	10	10	17	13	9
III	182	5	13	20	31	38	48	27
IV	303	61	63	76	49	46	8	0
V	505	273	166	53	9	3	0	1
VI	385	224	109	28	5	13	4	2
VII	82	1	6	6	8	26	30	5
VIII	231	36	41	44	27	72	10	1
IX	16	0	0	0	3	10	2	1
X	15	0	0	1	1	9	4	0
XI	18	0	1	1	1	13	2	0
XII	24	0	1	8	5	7	3	0
Hawaii	8	5	1	1	1	0	0	0
Total	1,887	614	413	260	159	262	133	46

repairs of old dwellings. In fact, those two Regions, together with Regions IV and VIII, account for more than 83 percent of the total for the four cost groups in table 3. The percentages in this table are based on the total cost, which includes purchase prices and fees.

TABLE 3.—*Loans from all funds which included amounts for new construction and improvements, fiscal year 1938*

Region	New dwellings			Repairs to dwellings			Other buildings[1]			Land improvement		
	Number	Amount used for	Percent of total cost	Number	Amount used for	Percent of total cost	Number	Amount used for	Percent of total cost	Number	Amount used for	Percent of total cost
I	0	0	0	21	$10,376	3.6	24	$14,579	5.0	4	$485	0.2
II	0	0	0	41	6,219	1.3	56	24,683	5.3	11	598	.1
III	0	0	0	120	28,030	2.0	146	56,502	4.0	107	19,639	1.4
IV	22	$31,222	2.1	244	64,683	4.4	252	59,890	4.1	227	47,854	3.3
V	139	137,038	7.9	348	107,835	6.2	487	111,086	6.4	407	57,524	3.3
VI	204	258,571	17.2	175	68,684	4.6	336	97,717	6.5	289	37,105	2.5
VII	2	2,260	.4	54	11,794	1.9	55	16,323	2.7	14	2,771	.5
VIII	56	60,272	4.7	160	52,575	4.1	199	56,145	4.4	141	19,379	1.5
IX	1	1,850	1.5	12	3,685	3.0	7	1,985	1.6	1	600	.5
X	6	9,972	7.7	10	2,778	2.2	13	8,908	6.9	8	1,762	1.4
XI	0	0	0	11	1,782	1.4	10	2,339	1.9	5	700	.5
XII	6	4,789	3.2	16	2,733	1.8	23	6,538	4.4	9	572	.4
Hawaii	4	5,475	19.6	3	1,475	5.3	3	1,225	4.4	3	1,005	3.6
Total	440	511,449	5.5	1,215	362,649	3.9	1,611	457,920	4.9	1,226	189,994	2.0

[1] New building construction or repairs.

THE HOMESTEAD PROJECTS

THE homestead projects being completed by the Administration represent earlier experimental approaches to the problem of helping low-income farm families attain security on good land.

Rural homestead projects at present complete or under development number 146. Ultimately they will accommodate 15,417 families. On June 30, 1938, 76 projects were completed, providing homesteads for 6,264 families. Other projects still in the construction stage are sufficiently near completion to have families in residence. Families on all projects number 8,947.

RURAL HOMESTEADS

In order to explore the possibilities of various types of land purchase, home construction, land use, economic organization, farm practice, and community activities, the Administration has established projects of many types, each adapted to suit local conditions. No two projects are quite alike.

In general, however, the rural projects are of three major types—scattered-farm projects, farm-community projects, and subsistence-homestead projects.

SCATTERED FARMS

The scattered-farm projects offer low-income farm families opportunities very similar to those offered by the tenant-purchase program. Single farms, scattered through areas in which schools and community facilities are already available, are purchased by the Government. Farm buildings are repaired or rebuilt to meet minimum standards of sanitation and efficiency. Assistance in working out a sound farm and home plan and in financing its operation is extended to the family. The family then is given an opportunity to purchase the farm on a long-term, low-interest basis.

The procedure on the scattered-farm projects differs somewhat from that under the tenant-purchase program. Under the tenant-purchase program, land is directly acquired by the farmer himself. Under the project program, the farmer rents the farm for several crop years before entering contract for purchase. This test period is intended to make certain a satisfactory adjustment of the farmer to the land, before the long-term obligation is entered into. If, as is generally the case, the arrangement proves satisfactory, the rentals paid during the leasing period are applied to the purchase price.

FARM COMMUNITIES

The rural-community projects offer low-income farm families security on good land and an opportunity to plan long-range improvements, as do the tenant-purchase and scattered-farm projects. In addition, they offer opportunities for cooperative action by an entire

neighborhood, which may increase the efficiency of individual farm operations and broaden the horizons of farm life.

Large-scale farms that can use highly mechanized operation methods have, in some areas, become a serious threat to the small, family-sized farm enterprise. The small farm, for example, may not be large enough to justify the use of a tractor or other heavy machinery. If a number of small farmers band together, however, they can take advantage of these modern, large-scale methods, and at the same time preserve the traditional values of independent farm ownership.

As a rule, this banding together of small farmers living on the same project takes the form of a cooperative organization. Project cooperative associations on June 30 had a total membership of approximately 4,500 heads of homestead families. Loans during the year to 16 new cooperative organizations amounted to $2,202,735, and to cooperative organizations set up in previous years, $326,858, making a total of $2,529,563 in cooperative loans during the year. This amount brings the grand total of loans made to cooperative associations on resettlement projects, since the initiation of this service, to $6,761,472. Although they have not been advanced all of their loan funds and will not reach their full development for at least 2 more years, their total transactions during the fiscal year exceeded $3,000,000.

Rural communities can also carry on educational and social activities of the more wholesome types. Thirty-two combination school-community buildings, 26 community buildings, 9 school buildings, 14 health buildings, and 12 teacherages have been built in connection with resettlement projects.

SUBSISTENCE HOMESTEADS

The subsistence-homestead projects differ from the farm projects in offering families in industrial employments an increase in security, in the form of a supplemental farm income, rather than the more inclusive type of security derived entirely from a sound farm enterprise. The subsistence homesteads are designed to permit residents to raise much of their food on their own garden plots, while earning cash income either in nearby towns, or in industries established within the communities.

The subsistence homesteads were started in July 1933 by the Subsistence Homesteads Division of the Department of the Interior. The Resettlement Administration and its successor, the Farm Security Administration, later took them over. This Administration has now substantially completed 26 subsistence-homestead projects and 3 others are nearing completion. Twelve of the completed projects have been turned over for management to nonprofit associations formed by the residents.

These associations take title to the property, and give a mortgage to the Government. They are responsible for the collection of individual payments from the homesteaders, for managing and maintaining the community, and for paying off the debt to the Government. The communities are incorporated under the laws of their respective States and are subject to taxation just like any other village. The residents of most projects work in trades or industries already existing in nearby cities; but in a few cases small industries have been established on the project. Virtually all residents were raised on farms, or have had some farming experience.

LOW-COST CONSTRUCTION

As experience with the various types of projects matures, comparisons of their successes may yield information of vital importance to the future of American agriculture. Already, however, the project program has developed certain building methods that may prove of major significance to American industry.

In the course of 3 years' experience, engineers of the Farm Security Administration have devised low-cost methods of rural home building that set new standards in that field. They have worked out a system of precutting and prefabrication on a mass-production basis that makes it possible to build sturdy, attractive rural homes for as little as $250 a room.

Construction of the earliest projects was started under the pressure of a national emergency, to provide speedy employment for men on relief. It was inevitable that the cost of building some of the first homes should be undesirably high.

When the Resettlement Administration was transferred to the Department of Agriculture on January 1, 1937, immediate steps were taken to reduce construction costs to an absolute minimum. It was determined that the construction cost of a farm unit, including home and outbuildings, should be limited to between $2,900 and $4,200, the higher-cost units in the Northern States, where more insulation and weather protection is necessary. These standards were not set at the expense of quality construction. With reasonable maintenance, the houses being built within these cost limits should last considerably longer than the period required to amortize the investment.

The first step in reducing construction costs was to work out scientific plans and specifications, which would give maximum space and utility for the smallest possible expenditure. Every unnecessary gable, beam, and rafter was eliminated. No purely decorative features were used. Standard materials and sizes were employed throughout.

Designs of this type made possible a large degree of precutting and prefabrication. A small portable sawmill, set up on the project site to cut lumber for a large number of similar houses according to exact specifications, reduced costs and increased accuracy of cutting. Precut planks and timbers were then assembled into standard panels. Building of wall sections in this manner requires only a fraction of the time and cost consumed by ordinary methods.

A truck then delivers sections and joining timbers to the building site where they are speedily nailed together. Complicated parts, such as window and door frames, are prefabricated at the mill, so thay can be installed with a minimum of labor. Even forms for pouring concrete foundations are made at the mill. Painted inside with creosote before every pouring, each one can be used six or seven times.

Precutting at the sawmill takes only about one-sixth of the time that would be required for cutting with handsaws at the building site. In addition to assuring machine precision, it makes possible more uniform supervision. Selection of stock is simplified, so that odds and ends of lumber which ordinarily would go to the scrap heap can be put to good use.

These methods made it practicable to use relatively unskilled rural labor, without lowering standards of workmanship. Whenever possible, the homes were built by the people who were to live in them and pay for them; they had every incentive, therefore, to keep labor costs low.

Interior finishing is simple. In the South, the inside walls usually are made of vertical tongue-and-groove wooden sheathing; in the North, plastered walls and weatherboard exteriors were necessary to meet the more severe weather conditions. The ceilings of northern houses are insulated, while the roof peaks of southern houses are vented to permit a maximum circulation of air.

GREENBELT COMMUNITIES

Three of the Farm Security Administration's projects come under still another category. They are the greenbelt towns, developed in suburban areas of Washington, Cincinnati, and Milwaukee.

These three communities, initiated for the dual purpose of providing employment and demonstrating an improved type of community planning, contain 2,200 family units. They each include a number of farm units, although the projects are designed primarily to provide modest, wholesome homes for low-income families in crowded cities.

On June 30 construction was completed on all three suburban towns. It is intended that these projects will be so managed as to

foster a family and community life that is better than the residents previously enjoyed. The first families occupied homes in Greenbelt in October 1937; families started moving into Greenhills and Greendale in May 1938.

Table 4 gives figures concerning the number of dwellings in the greenbelt towns and the families living there on June 30.

TABLE 4.—*Occupancy, rent, and family data for greenbelt towns as of June 30, 1938*

Town	Dwellings [1]	Families in residence in suburban units	Average monthly rent	Average annual income of families in residence	Median age of family heads
	Number	*Number*	*Dollars*	*Dollars*	*Years*
Greenbelt, Md.	885	777	31.47	1,560	29
Greenhills, Ohio	676	235	25.00	1,771	33
Greendale, Wis.	572	191	28.63	1,624	33

[1] Exclusive of rural units which number 56 and 74 for Greenhills and Greendale, respectively.

Of the three suburban towns, Greenbelt, Md., was the only one with an established local government in operation at the close of the year. Greenhills and Greendale are still administered by managers appointed by the Administration, and are under the political jurisdiction of the county in which they are located. This arrangement will continue until the new towns are completely inhabited and a majority of the citizens petition their respective counties for the authority to establish their own government.

Greenbelt is a chartered town under the laws of the State of Maryland and has a city-manager form of government. This government consists of a town council, elected by the voters, and a town manager, appointed by the council. The council is composed of five members, of which one member, chosen by the remaining councilmen, is named mayor. The council, as representative of the voters and as the legislative unit of the government, also formulates policies of administration and operation.

The combination school-community buildings erected in the greenbelt towns provide an opportunity for a high quality of education and a wide variety of community activities. The school buildings will lend themselves to the type of education the residents of the community desire and can support. The facilities also can be used for practically any type of adult educational and recreational activities.

The schools in all three greenbelt towns are operated by the board of education of the county or school district in which they are located. In this way they are closely integrated with the educational system of the county and State.

In each of the communities general stores and service establish-

ments have been provided. Theaters also have been established at Greenbelt and Greendale, while at Greenhills the auditorium of the community building has been equipped for stage and film productions. In general, the education and community facilities have been grouped in a central location in the project to provide easy access from all residential areas.

The planning of the community organization has grown out of the sincere stimulation and advisory direction of organizations initiated by the local residents. In each community, committees have been chosen by the people to outline plans for the organization of an over-all educational, social, and recreational program. At Greenbelt, where the municipal government unit has already been established, these committees advised and worked with the town council.

When governmental units are developed in the other two communities, the committees now operating will, undoubtedly, take over the same function. In each of the communities these organizations have been developed and are operating in an efficient manner. One of the most noteworthy results of this community activity is the establishment of a health center at Greenbelt, and the planning for health centers at the other two projects.

REAL PROPERTY CONTROL

Maintenance and operation of projects has been a function of increasing importance in the Administration. On June 30, $774,418.31 was due, and of this amount $705,268.20 was collected, from families living on 86 projects. Including rents and purchase payments from three State rural rehabilitation corporation projects, 13 projects in which the Administration and State corporations made joint investments, and nonprofit community associations, the amount of $1,359,-368.47 was due. Collections totaling $1,150,315.77 were made.

Detailed studies were made of the operations of the 12 homestead associations organized during the previous year, including such problems as maintenance, taxes and insurance, and collections and accounting. In some instances, additional investments of funds held by the association have been authorized. Homestead associations have, for the most part, operated successfully with increasing participation on the part of the boards of directors, composed of homesteaders, in the actual management of the associations.

A new farmstead lease and purchase contract has been developed for use in the sale of farm properties to individual clients, where construction loans have not been made and homestead associations will not immediately be formed. This contract is based on the home-

steaders' ability to pay, in accordance with the production on their farm units. Thus payment will be dependent on actual production and will be calculated as a percentage of the crops. In this way, it is hoped that the economic position of the homesteaders will be stabilized.

In order to protect the Government's investment, properties are adequately covered by insurance. On June 30 a total of $36,024,015 in insurance certificates had been written on resettlement projects. In addition, there was outstanding coverage in the form of insurance binders totaling approximately $6,000,000. This insurance program has already proved its value in replacing buildings where losses have occurred.

Maintenance of properties has been cared for from reserve funds set up in part out of rents paid by residents on resettlement projects. In order to pay political subdivisions for educational and other services supplied to resettlement projects, 406 agreements were entered into at 62 projects, involving a total payment in lieu of taxes of $277,800.60.

UNSOLVED PROBLEMS

Problems closely related to those now within the scope of the Farm Security Administration, but not at present being met by adequate programs of action, have been the subject of inquiry during the year.

The increasing mechanization of farm production is changing many former tenants into migrant farm laborers. The problems of this group, precipitated down the agricultural ladder by circumstance, have not as yet found a satisfactory answer. On the Pacific coast, where many thousands of seasonal agricultural workers have for years presented serious economic and social problems, the camps of the Farm Security Administration have continued in operation. They furnish temporary residence and sanitary facilities to the migrants. Need for additional camps in that region, and in other regions where mechanization is increasing, has been studied carefully.

The camps, however, can by no means be termed a complete solution for the problems of this group of landless farmers. Some of the health aspects of the problem have been made less threatening; but little permanent security can be attained by migrant families through the camp program. Rehabilitation and security for these and other stranded groups are yet to be approached on a basis leading toward a permanent solution.

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REPORT OF THE DIRECTOR OF FINANCE, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF BUDGET AND FINANCE,
Washington, D. C., October 31, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith the report of the Office of Budget and Finance for the fiscal year ended June 30, 1938.

Sincerely,

W. A. JUMP, *Director.*

CONTENTS

	Page		Page
The Department budget	1	Division of Purchase, Sales, and Traffic	22
Regular funds	1	Bid transactions	22
Emergency funds	2	Property lists	23
Statistical tables	2	Coordination and contact work	23
Receipts from Department's activities, 1938	19	General survey of procurement and supply work	23
Division of Accounts	20	Changes in Department regulations	24
Bureau Accounting Service	21		

THE DEPARTMENT BUDGET

REGULAR FUNDS[1]

Regular appropriations of the Department of Agriculture aggregated $828,819,670 during the fiscal year 1938, to which was added $159,342,552 in balances from prior-year appropriations and transfers, making a total of $988,162,222 available. Against this sum, obligations totaling $782,210,517 were incurred, as shown in table 1.

TABLE 1.—*Regular appropriations and obligations of the Department of Agriculture, fiscal year 1938*

[For details, see tables 4 and 5]

Item	Appropriations, 1938	Obligations, 1938
Agricultural adjustment and related funds	[1] $648,075,766	[1] $420,473,966
Road funds	180,000,000	[2] 216,780,910
Payments to States for experiment stations, extension work, and cooperative forestry activities, including fire prevention	25,448,169	25,441,764
All other purposes	134,638,287	119,513,877
Total available	988,162,222	782,210,517
Deduct reappropriations and transfers included in foregoing	159,342,552	
Net total, regular funds (direct appropriations)	828,819,670	782,210,517

[1] Approximately $220,000,000 of 1938 funds reappropriated for 1939 or estimated for reappropriation for 1940.
[2] Represents road funds authorized for the fiscal year 1939 but actually made available for contractual obligations in 1938, as provided by law.

[1] For definition of "regular funds" and "emergency funds" as used herein, see page 1 of Annual Report for 1937.

EMERGENCY FUNDS [1]

In addition to the regular budget, emergency funds amounting to $182,176,035 were allocated to the Department. Obligations totaling $179,847,590 were incurred against these allocations and balances from allocations made in prior years, as shown in table 2.

TABLE 2.—*Emergency funds allocated to Department of Agriculture, fiscal year 1938*
[For details, see table 10]

Act	Allocations, 1938	Obligations, 1938
National Industrial Recovery Act		$264,164
Emergency Appropriation Act, 1935	$20,000	25,147
Supplemental Appropriation Act, 1936 (substitution for Puerto Rico and Hawaii trust funds under appropriation Payments for agricultural adjustment)		135,502
Emergency Relief Appropriation Act of 1935	3,200	3,545
Emergency Relief Appropriation Act of 1936	152,800	20,449,888
Emergency Relief Appropriation Act of 1937	182,000,035	158,969,344
Total	182,176,035	179,847,590

STATISTICAL TABLES

Tables 3 to 10, inclusive, which follow, analyze the Department's regular budget for the fiscal years 1938 and 1939, and show allocations and obligations under emergency funds for each of the fiscal years 1937 and 1938. Since at the time of preparing this report (October 1) only 3 months of the fiscal year 1939 had elapsed, it was impracticable to forecast allocations from emergency funds for the entire year; data for the complete fiscal year 1939 will be included in the 1939 report.

TABLE 3.—*Source of regular appropriations of Department of Agriculture, fiscal years 1938 and 1939 (as of Oct. 1, 1938)*

Source	Appropriation, 1938 (revised)	Appropriation, 1939
Agricultural Appropriation Act:		
Department proper	[1] $287,006,208	[1] $347,865,279
Agricultural Adjustment and related funds:		
Conservation and use of agricultural land resources, Department of Agriculture	[2] 340,000,000	[2] 345,000,000
Sugar Act of 1937		48,000,000
Retirement of cotton pool participation trust certificates		1,800,000
Section 32, act of Aug. 24, 1935 (exportation and domestic consumption of agricultural commodities, Department of Agriculture)	125,097,214	144,024,893
Act of July 17, 1937 (Pub. Res. 55, 75th Cong.): Control of incipient and emergency outbreaks of insect pests	1,000,000	
Act of Mar. 2, 1938 (Pub. Res. 81, 75th Cong.): Control of incipient and emergency outbreaks of insect pests	2,000,000	
Third Deficiency Appropriation Act, 1937:		
Dry-land agriculture investigations (Woodward, Okla., station)	76,000	
Bankhead-Jones Farm Tenant Act	20,000,000	
Sugar Act of 1937	250,000	
Act of Feb. 4, 1938 (Pub. Res. 78, 75th Cong.): Sugar Act of 1937	39,750,000	
First Deficiency Appropriation Act, 1938: Fighting forest fires	1,279,417	
Second Deficiency Appropriation Act, 1938:		
Reconstruction and repair of flood-damaged roads and other improvements in California national forests	1,000,000	
Control of incipient and emergency outbreaks of insect pests		709,000
Maintenance of mammal and bird reservations		60,000
Administration of United States Warehouse Act		55,000
Mediterranean Fruit Fly Board, expenses		10,000
Work Relief and Public Works Appropriation Act of 1938:		
Rural rehabilitation—title 1, sec. 1 (3)—Farm Security Administration		175,000,000
Price Adjustment Act of 1938 (title V)—Agricultural Adjustment Administration		212,000,000

[1] Includes $125,000 advanced from Treasury from migratory-bird conservation fund, to be reimbursed from hunting-stamp sales receipts, and $625,000 from receipts over advances (estimated).
[2] In addition, $160,000,000 was reappropriated in 1938 and $155,000,000 in 1939 from unobligated balances of prior-year appropriations, making a total of $500,000,000 available for this purpose for each year.

[1] For definition of "regular funds" and "emergency funds" as used herein, see page 1 of Annual Report for 1937.

TABLE 3.—*Source of regular appropriations of Department of Agriculture, fiscal years 1938 and 1939 (as of Oct. 1, 1938)*—Continued

Source	Appropriation, 1938 (revised)	Appropriation, 1939
Permanent annual, indefinite, and special appropriations:		
Cooperative agricultural extension work (Smith-Lever Act)	$4,701,165	$4,701,165
Payments to States and Territories (national-forest fund)	1,200,000	1,275,000
Payments to school funds, Arizona and New Mexico (national-forest fund)	30,000	30,000
Roads and trails for States (national-forest fund)	400,000	510,000
Cooperative work, Forest Service (contributed funds)	1,000,000	1,000,000
Payments to counties under Migratory Bird Conservation Act	15,000	15,000
Seafood inspection fees (Food and Drug Administration)	72,735	62,500
Payments in lieu of taxes and for operation and maintenance of resettlement projects (trust account)—Farm Security Administration	145,915	793,549
State Rural Rehabilitation Corporation funds (trust account)—Farm Security Administration	3,693,992	8,941,530
Miscellaneous contributed funds (trust account)	102,024	200,000
Total, permanent, indefinite, etc	11,360,831	17,528,744
Total, regular funds	828,819,670	1,292,043,916

TABLE 4.—*Summary of regular Department of Agriculture funds, classified by groups and bureau units, fiscal years 1938 and 1939*

Activity	Appropriation, 1938	Obligations, 1938	Appropriation, 1939 [1]
Ordinary activities:			
Office of the Secretary	$591,450	$580,225	[2] $870,825
Office of the Solicitor	194,160	193,528	[2] 219,240
Office of Information	1,254,130	1,253,486	[2] 1,474,770
Library	105,420	104,920	105,420
Office of Experiment Stations	231,046	229,234	228,980
Special research fund, Department of Agriculture	1,200,000	1,146,041	1,400,000
Extension Service	901,754	875,091	892,254
Weather Bureau	4,763,049	4,656,757	4,987,870
Bureau of Animal Industry	26,237,098	23,783,277	20,736,731
Bureau of Dairy Industry	703,694	698,661	717,405
Bureau of Plant Industry	4,809,048	4,779,536	4,741,675
Forest Service	15,116,596	14,095,706	14,310,400
Bureau of Chemistry and Soils	1,425,431	1,408,901	1,457,508
Bureau of Entomology and Plant Quarantine	5,711,398	5,577,061	5,621,867
Bureau of Biological Survey	2,002,840	1,993,014	2,123,340
Bureau of Agricultural Engineering	460,769	457,884	510,000
Bureau of Agricultural Economics	6,212,698	6,093,153	6,566,483
Bureau of Home Economics	245,085	244,585	305,085
Commodity Exchange Administration	500,000	496,859	635,000
Food and Drug Administration	2,227,758	2,213,671	2,227,758
Soil Conservation Service	24,390,780	23,204,318	23,525,000
Beltsville Agricultural Research Center	75,000	74,500	85,000
Total [3]	99,299,204	94,154,408	93,742,611
Special items [3]	7,379,417	6,445,506	6,190,000
Receipts and contributed funds [3]	7,459,666	7,257,808	13,627,579
Payments to States (exclusive of road funds and receipt funds) [3]	25,448,169	25,441,764	27,558,833
Farm Tenant Act [3]	20,000,000	11,331,822	40,668,178
Rural rehabilitation [3]			197,816,758
Agricultural adjustment and related funds [4]	648,075,766	420,473,966	904,024,893
Federal Crop Insurance Act [3]			25,500,000
Road funds [3]	180,000,000	216,780,910	201,500,000
Flood control [3]	500,000	324,333	7,000,000
Gross total, regular funds (including reappropriations and transfers)	988,162,222	782,210,517	1,517,623,852
Deduct reappropriations and transfers included in foregoing [2]	−159,342,552		−225,584,936
Net total, regular funds (excluding reappropriations and transfers)	828,819,670	782,210,517	1,292,043,916

[1] As of Oct. 1, 1938.

[2] Increases for 1939, under Offices of the Secretary, the Solicitor, and Information consist principally of funds transferred from the Soil Conservation Service for departmental services arising out of the work of the Soil Conservation Service.

[3] For details, see table 5.

[4] For details, see tables 6 and 7.

TABLE 5.—*Detailed statement, by bureaus and appropriation items, of regular Department of Agriculture funds, fiscal years 1938 and 1939*

Bureau and item	Appropriation, 1938 (revised)	Obligations, 1938	Appropriation, 1939 [1]
Ordinary activities:			
Office of the Secretary:			
Salaries	$452,700	$452,584	$581,920
Miscellaneous expenses	105,750	97,571	108,250
Rent of buildings in District of Columbia	33,000	30,070	180,655
Total	591,450	580,225	870,825
Office of the Solicitor: Salaries and expenses	194,160	193,528	219,240
Office of Information:			
Salaries and expenses	366,480	365,836	379,800
Printing and binding	887,650	887,650	1,094,970
Total	1,254,130	1,253,486	1,474,770
Library, Department of Agriculture: Salaries and expenses	105,420	104,920	105,420
Office of Experiment Stations:			
Administration of grants to States and coordination of research	161,735	159,961	161,735
Insular experiment stations:			
Hawaii	2,066	2,065	
Puerto Rico	67,245	67,208	67,245
Total	231,046	229,234	228,980
Special research fund, Department of Agriculture	1,200,000	1,140,041	1,400,000
Extension Service:			
General administrative expenses	126,246	123,313	126,246
Farmers' cooperative demonstration work	554,670	533,449	545,170
Motion pictures	79,000	76,886	79,000
Agricultural exhibits at fairs	85,000	84,898	85,000
Cooperative farm forestry extension work (Clarke-McNary Act)	56,838	56,545	56,838
Total	901,754	875,091	892,254
Weather Bureau:			
General administrative expenses	170,000	169,098	145,000
General weather service and research	2,342,870	2,333,995	2,342,870
Aerology	2,190,179	2,153,664	2,500,000
Total	4,703,049	4,656,757	4,987,870
Bureau of Animal Industry:			
General administrative expenses	178,220	176,565	178,220
Animal husbandry	789,380	780,880	789,380
Diseases of animals	447,775	434,302	447,000
Eradicating tuberculosis and Bang's disease:			
Direct appropriation	1,603,000	1,563,956	5,403,000
Reappropriation of unobligated balances of funds provided by Jones-Connally Act (May 25, 1934) and sec. 37 of act of Aug. 24, 1935	15,864,000	13,557,600	6,600,000
Eradicating cattle ticks	513,940	508,440	503,940
Hog-cholera control	127,192	118,867	122,000
Inspection and quarantine	680,000	667,160	680,000
Meat inspection	5,433,000	5,398,515	5,412,600
Virus-Serum-Toxin Act	218,712	213,992	218,712
Packers and Stockyards Act	381,879	363,000	381,879
Total	26,237,098	23,783,277	20,736,731
Bureau of Dairy Industry:			
General administrative expenses	70,495	70,435	70,495
Dairy investigations	633,199	628,226	646,910
Total	703,694	698,661	717,405
Bureau of Plant Industry:			
General administrative expenses	189,242	188,953	189,242
Arlington farm	49,414	47,358	49,414
Botany	76,635	76,259	76,635
Cereal crops and diseases	541,721	534,792	532,371
Cotton and other fiber crops and diseases	406,435	404,830	399,385
Drug and related plants	47,139	44,343	47,139

[1] As of Oct. 1, 1938.

TABLE 5.—*Detailed statement, by bureaus and appropriation items, of regular Department of Agriculture funds, fiscal years 1938 and 1939*—Continued

Bureau and item	Appropriation, 1938 (revised)	Obligations, 1938	Appropriation, 1939
Ordinary activities—Continued.			
Bureau of Plant Industry—Continued.			
Dry-land agriculture	[2] $291,578	$290,378	$226,828
Experimental greenhouse maintenance	78,632	78,527	77,372
Forage crops and diseases	300,193	297,307	294,993
Forest pathology	259,592	256,797	255,392
Fruit and vegetable crops and diseases	1,179,482	1,178,402	1,289,182
Genetics and biophysics	31,675	30,475	31,675
Mycology and disease survey	45,818	45,591	45,818
National Arboretum	122,000	121,934	54,587
Nematology	48,961	48,877	48,961
Plant exploration and introduction	204,483	204,054	200,933
Plant nutrition	16,024	15,883	16,024
Rubber and other tropical plants	46,749	46,677	46,749
Seed investigations	72,293	71,138	72,293
Soil-fertility investigations	172,157	171,880	168,457
Soil-microbiology investigations	39,854	39,182	39,854
Sugar-plant investigations	[3] 328,700	328,116	322,500
Tobacco investigations	137,744	135,981	135,544
Western irrigation agriculture	122,527	121,802	120,327
Total	4,809,048	4,779,536	4,741,673
Forest Service:			
General administrative expenses	607,500	606,900	607,500
National forest protection and management	11,425,950	11,407,169	11,569,754
Reconstruction and repair of roads and other improvements, national forests in California	[4] 1,000,000		
Water rights	10,000	10,000	20,000
Fighting forest fires	100,000	100,000	100,000
Forest management	638,403	637,718	648,403
Range investigations	225,935	225,600	225,935
Forest products	628,361	628,258	628,361
Forest survey	220,000	219,742	250,000
Forest economics	121,295	121,235	121,295
Forest influences	139,152	139,084	139,152
Total	15,116,596	14,095,706	14,310,400
Bureau of Chemistry and Soils:			
General administrative expenses	90,241	89,706	90,200
Agricultural chemical investigations	360,260	356,436	372,500
Industrial utilization of farm products and byproducts	196,243	193,279	236,200
Agricultural fires and explosive dusts	48,403	48,043	40,000
Naval stores investigations	81,400	80,463	79,400
Soil survey	301,208	296,051	298,708
Soil chemical and physical investigations	78,081	76,782	76,700
Fertilizer investigations	269,595	268,141	263,800
Total	1,425,431	1,408,901	1,457,508
Bureau of Entomology and Plant Quarantine:			
General administrative expenses	166,280	165,694	166,280
Fruit insects	428,600	414,475	428,600
Japanese beetle control	425,000	419,003	395,000
Mexican fruitfly control	160,460	147,968	160,460
Citrus canker eradication	13,485	13,435	13,485
Sweetpotato weevil control	75,000	64,627	75,000
Phony peach and peach mosaic eradication	89,800	89,550	89,800
Forest insects	253,100	245,955	253,100
Gypsy and brown-tail moth control	400,000	398,346	375,000
Blister rust control	300,000	292,657	300,000
Dutch elm disease eradication	460,860	447,849	378,489
Truck crop and garden insects	381,580	381,062	381,580
Cereal and forage insects	364,329	361,555	363,669
European corn borer control	32,939	30,781	32,939
Barberry eradication	200,000	198,807	200,000
Cotton insects	144,544	143,130	144,544
Pink bollworm control	296,800	293,717	446,800
Thurberia weevil control	2,808	2,774	2,808
Bee culture	83,000	81,954	83,000
Insects affecting man and animals	182,600	179,738	191,100
Insect pest survey and identification	159,790	158,657	149,790
Foreign parasites	38,000	37,590	38,000
Control investigations	[5] 72,518	69,018	72,518

[2] Includes $76,000 provided by Third Deficiency Appropriation Act, 1937, for regrassing studies at Woodward (Okla.) field station.
[3] Exclusive of $100,000 for sugar laboratory at Houma, La., shown under Special items.
[4] Provided by Second Deficiency Appropriation Act, 1938 (available until Sept. 30, 1938).
[5] Includes $10,000 under Fumigation investigations, merged with this item.

TABLE 5.—*Detailed statement, by bureaus and appropriation items, of regular Department of Agriculture funds, fiscal years 1938 and 1939*—Continued

Bureau and item	Appropriation, 1938 (revised)	Obligations, 1938	Appropriation, 1939
Ordinary activities—Continued.			
Bureau of Entomology and Plant Quarantine—Contd.			
Insecticide and fungicide investigations	$148,984	$148,718	$123,984
Transit inspection	44,059	43,052	44,059
Foreign plant quarantines	680,000	675,736	680,000
Certification of exports	31,862	31,592	31,862
Screwworm control	75,000	39,621	
Total	5,711,398	5,577,061	5,621,867
Bureau of Biological Survey:			
General administrative expenses	110,000	109,613	110,000
Food habits of birds and animals	68,140	67,547	68,140
Fur resources investigations	66,000	64,880	91,000
Biological investigations	171,149	168,887	171,149
Control of predatory animals and injurious rodents	612,000	609,022	650,000
Protection of migratory birds	315,000	314,100	315,000
Enforcement of Alaska game law	130,798	129,886	130,798
Maintenance of mammal and bird reservations	450,000	449,121	[6] 507,500
Migratory bird conservation refuges	79,753	78,043	79,753
Upper Mississippi River Wildlife Refuge		[7] 1,915	
Total	2,002,840	1,993,014	2,123,340
Bureau of Agricultural Engineering:			
General administrative expenses	37,600	37,562	37,600
Agricultural engineering investigations	423,169	420,322	472,400
Total	460,769	457,884	510,000
Bureau of Agricultural Economics:			
General administrative expenses	236,306	235,897	236,306
Farm management and practice	376,580	349,506	346,580
Marketing and distributing farm products	808,650	790,475	823,650
Crop and livestock estimates	686,289	683,277	671,289
Foreign competition and demand	298,000	296,889	295,000
Market inspection of farm products	426,500	423,125	450,000
Tobacco Inspection Act	275,000	261,759	365,000
Market news service	1,077,000	1,061,870	1,122,302
Perishable Agricultural Commodities Act	143,896	143,269	143,890
Standard Container, Hamper, and Produce Agency Acts	30,238	29,651	27,738
Peanut stocks and standards	10,000	6,581	10,000
Tobacco stocks and standards	17,187	15,963	17,187
Cotton Quality Statistics and Classing Acts	224,517	223,763	450,000
United States Cotton Futures and United States Cotton Standards Acts	501,900	478,929	491,900
United States Grain Standards Act	723,941	721,799	723,941
United States Warehouse Act	326,700	324,272	391,700
Wool marketing studies	50,000	46,128	[8]
Total	6,212,698	6,093,153	6,566,483
Bureau of Home Economics:			
General administrative expenses	31,735	31,585	31,735
Home economics investigations	213,350	213,000	273,350
Total	245,085	244,585	305,085
Commodity Exchange Administration: Enforcement of Commodity Exchange Act	500,000	496,859	635,000
Food and Drug Administration:			
General administrative expenses	100,802	100,581	100,802
Enforcement of Food and Drugs Act	1,750,000	1,746,675	1,750,000
Enforcement of Tea Importation Act	40,094	39,422	40,094
Naval Stores Act	34,700	33,553	34,700
Enforcement of Insecticide Act	208,180	206,558	208,180
Enforcement of Milk Importation Act	19,241	18,619	19,241
Enforcement of Caustic Poison Act	24,741	23,896	24,741
Enforcement of Filled Milk Act	10,000	4,967	10,000
Enforcement of Sea Food Inspectors Act	40,000	40,000	46,000
Total	2,227,758	2,213,671	2,227,758

[6] Includes $60,000 provided by Second Deficiency Appropriation Act, 1938.
[7] Obligated under balance from prior-year continuing appropriation.
[8] Amount reduced to $40,000 and item merged with Marketing and distributing farm products in 1939.

TABLE 5.—*Detailed statement, by bureaus and appropriation items, of regular Department of Agriculture funds, fiscal years 1938 and 1939*—Continued

Bureau and item	Appropriation, 1938 (revised)	Obligations, 1938	Appropriation, 1939
Ordinary activities—Continued.			
Soil Conservation Service:			
General administrative expenses	$675,000	$674,771	$552,050
Soil and moisture conservation and land use investigations	1,540,780	1,523,536	1,510,601
Soil and moisture operations, demonstrations, and information	22,175,000	21,006,011	21,462,349
Total	24,390,780	23,204,318	23,525,000
Beltsville agricultural research center	75,000	74,500	85,000
Total, ordinary activities	99,299,204	94,154,408	93,742,611
Special items:			
Forest-fire deficiency (Forest Service)	[9] 1,279,417	1,261,989	
Acquisition of lands for national forests (Forest Service)	3,000,000	2,805,821	3,000,000
Private forestry cooperation (Forest Service)			100,000
Sugar laboratory, Houma, La. (Bureau of Plant Industry)	100,000	99,500	
Water Facilities Act, arid and semiarid areas			500,000
Tobacco laboratory, Oxford, N. C. (Bureau of Entomology and Plant Quarantine)			80,000
Retirement of cotton pool participation trust certificates (Agricultural Adjustment Administration)			1,800,000
Mediterranean Fruit Fly Board, expenses			10,000
Incipient and emergency outbreaks of insect pests (Bureau of Entomology and Plant Quarantine)	3,000,000	2,278,196	700,000
Total, special items	7,379,417	6,445,506	6,190,000
Receipts and contributed funds:			
Forest Service:			
Acquisition of lands in Uintah and Wasatch National Forests	50,000	41,566	50,000
Payments to States and Territories	1,200,000	1,214,547	1,275,000
Payments to school funds, Arizona and New Mexico	30,000	27,995	30,000
Roads and trails for States	400,000	476,030	510,000
Cooperative work (contributed funds)	1,000,000	1,064,754	1,000,000
Bureau of Biological Survey:			
Migratory-bird conservation fund	[10] 750,000	416,852	[10] 750,000
Payments to counties under Migratory Bird Conservation Act	15,000	15,087	15,000
Food and Drug Administration: Sea food inspections (contributed funds—fees)	72,735	59,046	62,500
Farm Security Administration:			
Payments in lieu of taxes and for operation and maintenance of resettlement projects	145,915	145,915	793,549
State Rural Rehabilitation Corporation funds	3,693,992	3,693,992	8,941,530
Miscellaneous contributed funds	102,024	102,024	200,000
Total, receipts and contributed funds	7,459,666	7,257,808	13,627,579
Payments to States (exclusive of road funds and receipt funds):			
Office of Experiment Stations (for research work of State agricultural experiment stations):			
Hatch Act	720,000	720,000	720,000
Adams Act	720,000	720,000	720,000
Purnell Act	2,880,000	2,880,000	2,880,000
Hawaii	50,000	50,000	55,000
Alaska	22,500	22,500	23,750
Puerto Rico	40,000	40,000	42,500
Title I, Bankhead-Jones Act	1,800,000	1,800,000	2,100,000
Total	6,232,500	6,232,500	6,541,250
Extension Service (for extension work of State agricultural colleges):			
Smith-Lever Act (permanent annual)	4,701,165	4,701,165	4,701,165
Supplementary cooperative extension work (Smith-Lever Act)	790,000	790,000	395,000
Capper-Ketcham extension work	1,480,000	1,480,000	1,480,000
Extension work, sec. 21, Bankhead-Jones Act	10,000,000	10,000,000	11,000,000
Alaska	18,918	18,918	21,418
Puerto Rico			45,000
Additional cooperative extension work	500,000	500,000	275,000
Total	17,490,083	17,490,083	17,917,583

[9] Provided by First Deficiency Appropriation Act, 1938.

[10] Estimated receipts from sale of hunting stamps; includes $125,000 advanced from Treasury by Agricultural Appropriation Act, to be reimbursed from hunting-stamp receipts.

TABLE 5.—*Detailed statement, by bureaus and appropriation items, of regular Department of Agriculture funds, fiscal years 1938 and 1939*—Continued

Bureau and item	Appropriation, 1938 (revised)	Obligations, 1938	Appropriation, 1939
Payments to States—Continued.			
Forest Service:			
Forest-fire cooperation	$1,655,007	$1,648,602	$2,000,000
Cooperative distribution of forest planting stock (Clarke-McNary Act)	70,579	70,579	[11] 100,000
Total	1,725,586	1,719,181	2,100,000
Bureau of Biological Survey: Federal aid to States in wildlife restoration projects			1,000,000
Total, payments to States	25,448,169	25,441,764	27,558,833
Farm Tenant Act:			
Farm Security Administration:			
Farm tenancy (loans) (title I):			
Direct appropriation	10,000,000	9,520,215	25,000,000
Reappropriation			479,785
Liquidation and management of resettlement projects (title IV)			2,000,000
Bureau of Agricultural Economics:			
Land utilization and retirement of submarginal lands (title III):			
Direct appropriation	10,000,000	1,811,607	5,000,000
Reappropriation			8,188,393
Total, Farm Tenant Act	20,000,000	11,331,822	40,668,178
Rural rehabilitation (Farm Security Administration):			
Loans, relief, and rural rehabilitation (Emergency Relief Appropriation Act of 1938):			
Direct appropriation			175,000,000
Reappropriation			22,816,758
Total, rural rehabilitation			197,816,758
Agricultural adjustment and related funds:			
Conservation and use of agricultural land resources:			
Direct appropriation	[12] 340,000,000		345,000,000
Reappropriations and transfers	[13] 160,000,000		155,000,000
Total, conservation and use of agricultural land resources	500,000,000	[14] 334,963,896	500,000,000
Price Adjustment Act of 1938 (title V, Works Relief and Public Works Appropriation Act of 1938)			212,000,000
Exportation and domestic consumption of agricultural commodities (sec. 32, act of Aug. 24, 1935)	125,097,214		
Transferred to Conservation and use of agricultural land resources, 1938	−17,021,448		
Net, sec. 32	108,075,766	[15] 56,110,084	144,024,893
Sugar Act of 1937	40,000,000	25,000,000	48,000,000
Salaries and expenses, Agricultural Adjustment Administration		[16] 1,100,494	
Payments for agricultural adjustment, Agricultural Adjustment Administration		[17] 2,505,205	
Preliminary conservation payments		[18] 794,287	
Total, agricultural adjustment and related funds (including reappropriations)	648,075,766	420,473,966	904,024,893

[11] Carried in 1939 Agricultural Appropriation Act under title "Cooperative Farm Forestry."
[12] $25,500,000 balance from this fund reappropriated in 1939 under Federal Crop Insurance Act.
[13] Includes $17,021,448 transferred from Exportation and domestic consumption of agricultural commodities, 1938.
[14] Includes $681,353 transferred to Federal Crop Insurance Corporation.
[15] Includes $44,253,310 transferred to Federal Surplus Commodities Corporation. In addition, this Corporation obligated in 1938 $4,270,961 from Federal Emergency Relief Administration funds (contributed by State relief administrations).
[16] Obligations incurred under $100,000,000 appropriation provided by sec. 12 (a), act of May 12, 1933.
[17] Obligations incurred under $296,185,000 appropriation provided by Supplemental Appropriation Act, 1936.
[18] Obligations incurred in 1938 under reappropriation from Conservation and use of agricultural land resources, 1937.

TABLE 5.—*Detailed statement, by bureaus and appropriation items, of regular Department of Agriculture funds, fiscal years 1938 and 1939*—Continued

Bureau and item	Appropriation, 1938 (revised)	Obligations, 1938	Appropriation, 1939
Federal Crop Insurance Act:			
Reappropriation from Conservation and use of agricultural land resources, 1938:			
Administrative and operating expenses		[19]	$5,500,000
Subscription to capital stock, Federal Crop Insurance Corporation (Treasury Department)			20,000,000
Total, Federal Crop Insurance Act			25,500,000
Road funds:			
Federal aid (rural post roads)		[20] $280,910	
Federal-aid highway system	[21] $150,000,000	[22] 125,000,000	[21] 125,000,000
Federal-aid secondary or feeder roads	[21] 5,000,000	[22] 25,000,000	[21] 20,000,000
Elimination of grade crossings	[21] 10,000,000	[22] 50,000,000	[21] 40,000,000
Public-lands highways	[21] 2,500,000	[22] 2,500,000	[21] 2,500,000
Forest roads and trails	[21] 12,500,000	[22] 14,000,000	[21] 14,000,000
Total, road funds	180,000,000	216,780,910	201,500,000
Flood control (transfer from War Department):			
Examination and surveys	500,000	[23] 324,333	3,000,000
Improvement projects (works and measures)			4,000,000
Total, flood control	500,000	324,333	7,000,000
Gross total, regular funds (including reappropriations and transfers)	988,162,222	782,210,517	1,517,628,852
Deduct reappropriations and transfers included in foregoing:			
Eradicating tuberculosis and Bang's disease (Bureau of Animal Industry)	−15,864,000		−6,600,000
Flood control (transfer from War Department)	−500,000		−7,000,000
Farm Tenant Act:			
Title I (tenancy loans)			−479,785
Title III (submarginal land program)			−8,188,393
Rural rehabilitation			−22,816,758
Conservation and use of agricultural land resources	−142,978,552		−155,000,000
Federal Crop Insurance Act			−25,500,000
Total, reappropriations and transfers	−159,342,552		−225,584,936
Net grand total, regular funds (excluding reappropriations and transfers)	828,819,670	782,210,517	1,292,043,916

[19] $681,353 obligated in 1938 under Administration of the Agricultural Adjustment Act of 1938 (reappropriation from item Conservation and use of agricultural land resources, 1938 (see table 7).
[20] Obligated for highway research out of prior-year appropriations.
[21] Actual appropriations for fiscal years indicated.
[22] 1939 authorizations actually apportioned and obligated in 1938 (act of June 16, 1936).
[23] Consists, by bureaus, of $9,354 for Office of the Secretary, $4,480 for Office of the Solicitor, $119,359 for Forest Service, $36,781 for Bureau of Agricultural Economics, $144,359 for Soil Conservation Service, and $10,000 for Agricultural Adjustment Administration.

TABLE 6.—*Funds available for Agricultural Adjustment and related activities, fiscal years 1937, 1938, and 1939*

Appropriation	1937	1938	1939
Conservation and use of agricultural land resources:			
Direct appropriation (Independent Offices Appropriation Act, 1937)	$440,000,000		
Authorized reappropriation from unobligated balance of Payments for agricultural adjustment (Supplemental Appropriation Act, 1936)	[1] 30,000,000		
Direct appropriation (Agricultural Appropriation Act, 1938)		$340,000,000	
Authorized reappropriations and transfers:			
Sec. 32 (act of Aug. 24, 1935):			
1937 funds		[2] 92,978,552	
1938 funds		[1] 17,021,448	
From balance of $100,000,000 provided by sec. 12 (a), act of May 12, 1933		[1] 50,000,000	
Direct appropriation (Agricultural Appropriation Act, 1939)			$345,000,000
Authorized reappropriations:			
From balance of sec. 12 (a) funds (act of May 12, 1933)			71,250,028
From balance of Payments for agricultural adjustment (1936)			38,749,972
From 1937 balance of funds under Conservation and use of agricultural land resources			45,000,000
Total available, conservation and use of agricultural land resources	470,000,000	500,000,000	500,000,000
Price Adjustment Act of 1938 (title V, Work Relief and Public Works Appropriation Act of 1938)			212,000,000
Exportation and domestic consumption of agricultural commodities:			
Total appropriation	109,139,621	125,097,214	144,024,893
Less authorized reappropriation to Conservation and use of agricultural land resources, 1938	—[2] 92,978,552	—[1] 17,021,448	
Total available, Exportation and domestic consumption of agricultural commodities	16,161,069	[3] 108,075,766	[3] 144,024,893
Sugar act of 1937		40,000,000	48,000,000
Total available, Agricultural adjustment and related funds	486,161,069	648,075,766	904,024,893
Adjustment on account of reappropriations and transfers	+62,978,552	—142,978,552	—155,000,000
Direct appropriations	549,139,621	505,097,214	749,024,893

[1] Actually none transferred.
[2] $90,000,000 of this amount actually transferred.
[3] $65,000,000 from 1938 and $65,000,000 from 1939 earmarked for Cotton price adjustment by Third Deficiency Appropriation Act, 1937.

TABLE 7.—*Obligations incurred under funds available for agricultural adjustment and related activities, fiscal years 1937 and 1938*

Item	1937 (revised)	1938
Salaries and expenses, Agricultural Adjustment Administration:		
Agricultural Adjustment Administration:		
Administrative expenses	$4,308,669	$869,610
Payments to cotton ginners	2,532,350	
International production control committees	4,021	10,000
Tobacco compacts and agreements among States	511	
Office of the Secretary	25,000	
Office of the Solicitor	268,434	116,775
Library	3,240	
Extension Service	17,449	8,500
Bureau of Animal Industry:		
Sixth World's Poultry Congress	5,059	
Marketing agreements with respect to hog cholera virus and serum	12,855	17,779
Bureau of Chemistry and Soils	13,540	
Bureau of Agricultural Economics	95,097	77,830
Department of Justice	5,100	
Treasury Department	12,500	
Total	[1] 7,303,825	1,100,494
Payments for Agricultural Adjustment:		
General program:		
Agricultural Adjustment Administration:		
Administrative expenses	3,535,764	258,830
Rental and benefit payments	89,037,472	2,192,871
Removal of agricultural surpluses	89,799	
Extension Service	186,332	29,943
Office of the Treasurer, Treasury Department		1,000
General Accounting Office	479	22,561
Payments for administrative expenses under Tobacco, cotton, and potato acts:		
Agricultural Adjustment Administration:		
Administrative expenses	16,823	
Redemption of tax payment warrants	20,991	
Office of the Secretary	5,528	
Administrative expenses, purchase and sale of seed (Agricultural Adjustment Administration)	7,819	
Total	[2] 92,901,007	2,505,205
Conservation and use of agricultural land resources, 1937:		
Agricultural Adjustment Administration:		
Administrative expenses	15,558,862	
Conservation payments	371,769,475	
Office of the Secretary	315,288	
Office of the Solicitor	98,161	
Office of Information	13,516	
Extension Service	1,297,233	
Forest Service	557,344	
Bureau of Agricultural Economics	470,797	
Bureau of Home Economics	7,484	
Soil Conservation Service	650	
Division of Disbursement, Treasury Department	325,000	
Office of the Treasurer, Treasury Department	85,000	
General Accounting Office	425,046	
Farm Credit Administration	3,600	
Reappropriated to Preliminary conservation payments (1938)		794,287
Total	390,927,456	794,287
Conservation and use of agricultural land resources, 1938:		
Agricultural Adjustment Administration:		
Administrative expenses		15,132,958
Conservation payments		315,724,214
Office of the Secretary		304,920
Office of the Solicitor		206,855
Office of Information		12,104
Library		3,240
Extension Service		973,577
Forest Service		437,248
Bureau of Agricultural Economics		387,536
Soil Conservation Service		12,758
Bureau of Standards		1,000
Division of Disbursement, Treasury Department		300,000
Office of Treasurer, Treasury Department		102,528
General Accounting Office		401,062

[1] Paid from appropriation of $100,000,000 provided by sec. 12 (a), Agricultural Adjustment Act of May 12, 1933.

[2] Paid from $296,185,000 appropriation provided by Supplemental Appropriation Act, 1936.

TABLE 7.—*Obligations incurred under funds available for agricultural adjustment and related activities, fiscal years 1937 and 1938*—Continued

Item	1937 (revised)	1938
Conservation and use of agricultural land resources, 1938—Continued.		
Administration of the Agricultural Adjustment Act of 1938:		
Agricultural Adjustment Administration (administrative expenses)	----------	$251,770
Office of the Solicitor	----------	19,129
Office of Experiment Stations	----------	115
Bureau of Chemistry and Soils	----------	11,529
Federal Crop Insurance Corporation	----------	681,353
Total	----------	334,963,896
Exportation and domestic consumption of Agricultural commodities:		
Agricultural Adjustment Administration:		
Removal of agricultural surpluses	$16,161,069	9,460,616
Administrative expenses	----------	1,029,160
Office of the Solicitor	----------	18,675
Extension Service	----------	260,797
Bureau of Home Economics	----------	3,500
Federal Surplus Commodities Corporation	----------	[3] 45,314,305
Total	16,161,069	56,087,053
Exportation and domestic consumption of agricultural commodities, 1936:		
Cotton price adjustment program of 1935:		
Agricultural Adjustment Administration:		
Administrative expenses	210,930	3,808
Adjustment payments	9,658,066	----------
Extension Service	476,539	6,245
General Accounting Office	50,251	12,978
Division of Disbursement, Treasury Department	10,000	----------
Total	[4] 10,405,786	23,031
Administration of Sugar Act of 1937:		
Agricultural Adjustment Administration:		
Administrative expenses	----------	228,082
Payments to producers	----------	24,744,412
Office of the Solicitor	----------	13,943
Division of Disbursement, Treasury Department	----------	10,000
Office of the Treasurer, Treasury Department	----------	221
General Accounting Office	----------	3,342
Total	----------	25,000,000
Elimination of diseased cattle:		
Agricultural Adjustment Administration:		
Administrative expenses	106,786	----------
Removal of agricultural surpluses	3,437,252	----------
Bureau of Agricultural Economics	368	----------
Bureau of Home Economics	4,982	----------
Total	[5] 3,549,388	----------
Grand total	521,248,531	420,473,966

[3] Including $5,275 transferred to Division of Disbursement, Treasury Department.
[4] Paid from $10,795,524 unobligated balance of appropriation made available from 1936 sec. 32 funds.
[5] Paid from unobligated balances of funds provided by Jones-Connally Act (acts of Apr. 7, 1934, and May 25, 1934) and sec. 37, act of Aug. 24, 1935.

TABLE 8.—*Obligations under regular appropriations, fiscal year 1938, classified by types of activity*

Type of activity	All objects except payments to States, road funds, agricultural adjustment, and farm tenancy, rehabilitation, and related work [1]		Payments to States (for experiment stations, extension work, and special forestry activities) [2]	Farm tenancy, rehabilitation, and related work	Road funds	Total	
	Amount	Percent				Amount	Percent
Research	[3] $18,978,029	18.23	[4] $6,232,500	[5] $333,876	$280,910	$25,825,315	3.30
Extension	1,467,232	1.41	[6] 17,490,083			18,957,315	2.42
Pest control or eradication	[7] 21,696,051	20.83				21,696,051	2.78
Regulatory work	13,174,115	12.65				13,174,115	1.68
Public-service activities	[8] 48,814,088	46.88	[9] 1,931,814			50,745,902	6.49
Road construction					216,500,000	216,500,000	27.68
Agricultural adjustment and related work						420,473,966	53.75
Farm tenancy, rehabilitation, and related work				[10] 14,837,853		14,837,853	1.90
Total	104,129,515	100.00	25,654,397	15,171,729	216,780,910	782,210,517	100.00
Percentage of grand total	13.31		3.28	1.94	27.72	100.00	

[1] Includes ordinary activities, special items, and receipts and contributed funds not paid to States.
[2] Exclusive of payments to States from road funds ($200,000,000).
[3] Includes $47,260 from Cooperative work, Forest Service, $14,934 from item Migratory bird conservation fund, and $44,996 from Forest-fire cooperation (for forest-taxation and timber-insurance studies).
[4] Payments to States, Alaska, Hawaii, and Puerto Rico for agricultural experiment stations.
[5] For investigational work in connection with land utilization and retirement of submarginal lands.
[6] Payments to States, Alaska, Hawaii, and Puerto Rico for cooperative agricultural extension work.
[7] Includes $15,121,556 for eradicating tuberculosis and Bang's disease and $2,278,196 for control of emergency outbreaks of insect pests.
[8] Includes $21,006,011 for soil and moisture conservation operations, demonstrations, and information.
[9] Consists of $1,242,542 paid to States from national-forest receipts, $1,603,606 for cooperative forest-fire prevention, $70,579 for cooperative distribution of forest planting stock, and $15,087 paid to counties under Migratory Bird Conservation Act.
[10] Consists of $9,520,215 for farm tenancy loans and grants, $1,477,731 for land utilization and retirement of submarginal lands, and $3,839,907 under Farm Security Administration trust funds available for resettlement and rural rehabilitation programs.

TABLE 9.—*Department of Agriculture regular funds allocated to research, fiscal years 1938 and 1939*

Bureau or activity	1938 (revised)	1939 (estimated)
Weather Bureau	$146,154	$142,449
Bureau of Animal Industry	1,219,347	1,339,225
Bureau of Dairy Industry	669,740	688,860
Bureau of Plant Industry	4,846,900	4,708,686
Forest Service	2,103,893	2,098,146
Bureau of Chemistry and Soils	1,408,901	1,457,508
Bureau of Entomology and Plant Quarantine	2,196,645	2,225,175
Bureau of Biological Survey	442,299	455,457
Bureau of Public Roads (highway research paid from regular road funds)	280,910	305,020
Bureau of Agricultural Engineering	427,184	479,300
Bureau of Agricultural Economics	1,452,070	1,430,328
Bureau of Home Economics	244,585	305,085
Food and Drug Administration	123,102	125,484
Soil Conservation Service	1,565,536	1,552,601
Farm Tenant Act (land utilization and retirement of submarginal lands)	333,876	978,500
Federal Crop Insurance Act		50,000
Office of Experiment Stations (exclusive of payments to States)	229,234	228,980
Special Research Fund (Bankhead-Jones Act of June 29, 1935)	1,140,041	1,400,000
Beltsville Agricultural Research Center	74,500	85,000
General department administration, including prorata of publication, legal, and library work	687,898	829,051
Total	19,592,815	20,884,855
Payments to State and Territorial experiment stations for research under Hatch, Adams, Purnell, and Bankhead-Jones Act	6,232,500	6,541,250
Grand total	25,825,315	27,426,105

TABLE 10.—*Detailed statement of emergency funds allocated to Department of Agriculture and of obligations incurred thereunder and from prior-year unobligated balances during the fiscal years 1937 and 1938*

Appropriation, bureau, and project	1937		1938	
	Allocations [1]	Obligations [2]	Allocations [1]	Obligations [2]
National Industrial Recovery Act (June 16, 1933):				
Office of the Secretary: Coordination of land use planning in connection with acquisition and development of wildlife refuges				$2,499
Office of the Solicitor: Legal work in connection with land acquisition for wildlife refuges		$70,206		25,387
Bureau of Animal Industry: Physical improvements		10,386		285
Bureau of Plant Industry: Construction of artesian well, Newell, S. Dak	$20,000	40,565		2,366
Forest Service:				
Transferred to Forest Service projects		2,863		
Physical improvements, control of tree-destroying insects and diseases, and forest research		10,257		
Total, Forest Service		13,120		
Bureau of Biological Survey:				
Acquisition and development of wildlife refuges		1,963,770		233,627
Expenses of North American Wildlife Conference		4,144		
Total, Bureau of Biological Survey		1,967,914		233,627
Bureau of Home Economics: Physical improvements	8,600	8,600		
Soil Conservation Service:				
Soil-erosion prevention (transferred from Interior Department)		23,803		
Construction of soil-erosion nurseries (transferred from Bureau of Plant Industry)		16,335		
Total, Soil Conservation Service		40,138		

[1] Net (recisions deducted).
[2] Including obligations under prior-year allocations from this appropriation.

TABLE 10.—*Detailed statement of emergency funds allocated to Department of Agriculture and of obligations incurred thereunder and from prior-year unobligated balances during the fiscal years 1937 and 1938*—Continued

Appropriation, bureau, and project	1937		1938	
	Allocations	Obligations	Allocations	Obligations
National Industrial Recovery Act—Continued.				
Farm Security Administration:				
Rural rehabilitation (former subsistence homestead projects)		$21,141		
Purchase of submarginal lands		55,014		
Total, Farm Security Administration		76,155		
Road funds:				
National-forest roads, trails, bridges, and related projects		11,467		
Improvement of roads at Beltsville, Md		88		
Total, road funds		11,555		
Total, National Industrial Recovery Act	$28,600	2,238,639		$264,164
Emergency Appropriation Act, 1935 (June 19, 1934):				
Office of the Secretary (Beltsville Agricultural Research Center):				
Construction of feed mill and granary	50,000	41,453		8,547
Acquisition of land and dismantling, moving, and repair of buildings			$20,000	12,075
Total, Office of the Secretary	50,000	41,453	20,000	20,622
Bureau of Animal Industry: Physical improvements at field stations		206,454		4,423
Bureau of Agricultural Engineering: Physical improvements		16,808		102
Soil Construction Service: Soil-erosion prevention (transferred from Interior Department)		54,187		
Bureau of Public Roads: Improvement of roads at Beltsville, Md		111		
Total, Emergency Appropriation Act, 1935	50,000	319,013	20,000	25,147
Payments for Agricultural Adjustment (under allotments from $700,000 provided by Supplemental Appropriation Act, 1936, in substitution for Puerto Rico and Hawaii trust funds, authorized by sec .8 of Jones-Costigan Act of May 9, 1934):				
Puerto Rico:				
Office of Experiment Stations: Experiments in propagation and breeding of tropical plants, and studies of domestic-animal parasites		33,595		4,288
Bureau of Chemistry and Soils: Soil surveys		6,683		42
Bureau of Entomology and Plant Quarantine: Insect pest survey		12,727		242
Soil Conservation Service: Soil-erosion survey		18,392		46,822
Total, Puerto Rico		71,397		51,394
Hawaii:				
Office of Experiment Stations:				
Taro investigations		17,805		5,722
Liver fluke eradication		14,439		11,199
Rat abatement campaign		66,593		4,336
Development of truck farming and improvement of marketing facilities for farm products		31,560		11,236
Development of livestock feed		33,451		25,307
Development of tropical fruits and nuts		28,924		9,631
Promotion of poultry industry		11,642		12,475
Bureau of Entomology and Plant Quarantine: Fruitfly control		19,500		4,202
Total, Hawaii		223,914		84,108
Total, payments for agricultural adjustment		295,311		135,502

TABLE 10.—*Detailed statement of emergency funds allocated to Department of Agriculture and of obligations incurred thereunder and from prior-year unobligated balances during the fiscal years 1937 and 1938*—Continued

Appropriation, bureau, and project	1937		1938	
	Allocations	Obligations	Allocations	Obligations
Emergency Relief Appropriation Act of 1935 (Apr. 8, 1935):				
Office of the Solicitor: Title-examination work in connection with forest and wildlife land acquisition:				
Regular allotment	$55,214	$523,329		
Emergency conservation work		7,080		
Total, Office of the Solicitor	55,214	530,409		
Office of Information: Printing of operating forms	15,000	14,958		
Extension Service: Wind-erosion control in southern Great Plains area		50,000		
Weather Bureau:				
Development of a method of long-range weather forecasting		1,631		
Repair or replacement of river gages damaged or destroyed by floods of 1936		5,000		
Total, Weather Bureau		6,631		
Bureau of Animal Industry:				
Eradication of liver flukes in sheep and cattle		77,209		
Elimination of cattle fever tick		84,572		
Physical improvements at Brooksville, Fla		168		
Total, Bureau of Animal Industry		161,949		
Forest Service:				
Physical improvements, protection and development work on national forests and adjacent privately owned lands, forestry research, etc		1,103,839		
Acquisition of forest lands	1,348,500	1,348,500		
Acquisition of forest lands, administrative expenses (Emergency Conservation Work)		5,976		
Acquisition of lands, Jefferson National Forest (Emergency Conservation Work)		60,000		
Administrative expenses	30,670	214,981	$3,200	$3,200
Total, Forest Service	1,379,170	2,733,296	3,200	3,200
Bureau of Entomology and Plant Quarantine:				
Brown-tail moth control		70,059		
Citrus canker eradication		12,212		
Gypsy moth control		255,899		
Peach mosaic survey and eradication		15,933		
Phony peach disease control		41,328		
White-pine blister rust control		844,192		
Barberry eradication for prevention of black stem rust		357,236		
Locating and destroying *Thurberia* plants		43,218		
Dutch elm disease eradication		177,508		
Locating and destroying wild cotton plants	33,054	40,248		
Administrative expenses		6,477		345
Total, Bureau of Entomology and Plant Quarantine	33,054	1,864,310		345
Bureau of Biological Survey:				
Development of wildlife refuges in North Dakota		46,108		
Acquisition of wildlife refuge areas	2,346	2,346		
Administrative expenses	6,100	9,786		
Total, Bureau of Biological Survey	8,446	58,240		
Soil Conservation Service:				
National program of soil conservation	137,849	2,502,703		
Administrative expenses		1,305,608		
Total, Soil Conservation Service	137,849	3,808,311		

TABLE 10.—*Detailed statement of emergency funds allocated to Department of Agriculture and of obligations incurred thereunder and from prior-year unobligated balances during the fiscal years 1937 and 1938*—Continued

Appropriation, bureau, and project	1937		1938	
	Allocations	Obligations	Allocations	Obligations
Emergency Relief Appropriation Act of 1935—Cont'd.				
Farm Security Administration:				
Resettlement projects		$34,606,112		
Purchase and development of submarginal lands	$788,513	4,249,091		
Administrative expenses		5,396,455		
Total, Farm Security Administration	788,513	44,251,658		
Total, Emergency Relief Appropriation Act of 1935, Department of Agriculture	2,417,246	53,479,762	$3,200	$3,545
Emergency Relief Appropriation Act of 1936 (June 22, 1936):				
Office of the Secretary: Departmental reserve	25,646			
Office of the Solicitor: Legal work in connection with acquisition of forest lands	146,200		2,532	125,554
Office of Information: Printing of operating forms			3,000	3,000
Bureau of Animal Industry:				
Eradication of liver flukes in sheep and cattle	74,045	72,695		
Elimination of cattle fever tick	490,784	490,586		
Total, Bureau of Animal Industry	564,829	563,281		
Forest Service:				
Construction and maintenance of national-forest improvements, control of fires, tree diseases, insects, and rodents and planting	12,468,597	12,468,597		
Surveying, mapping, and boundary tracing of national forests	1,407,212	1,407,212		
Developing of camping grounds, national forests	2,506,743	2,506,743		
Administrative expenses	856,099	494,632	101,468	458,109
Total, Forest Service	17,238,651	16,877,184	101,468	458,109
Bureau of Entomology and Plant Quarantine:				
Brown-tail moth control	460,749	460,363		
Citrus canker eradication	170,700	170,700		
Gypsy moth control	1,994,150	1,993,421		
Locating and removing peach mosaic	114,680	114,561		
Phony peach disease control	468,280	468,247		
White-pine blister rust control	2,823,013	2,821,070		
Barberry eradication for prevention of black stem rust	1,587,205	1,586,696		
Locating and destroying *Thurberia* plants	93,463	93,463		
Dutch elm disease eradication	4,238,538	4,237,890		
Mormon cricket control	333,000	321,915		
Administrative expenses	59,000	57,670	40,000	40,000
Total, Bureau of Entomology and Plant Quarantine	12,342,778	12,325,996	40,000	40,000
Bureau of Biological Survey:				
Development of wildlife refuges	1,570,429	1,567,048		
Administrative expenses	47,500	40,100	5,800	13,043
Total, Bureau of Biological Survey	1,617,929	1,607,148	5,800	13,043
Bureau of Public Roads: Construction and repair of roads and bridges damaged or destroyed by floods of 1936	9,580,141	9,580,141		
Bureau of Agricultural Economics: Survey of farm mortgages, land values, transfers, and farm taxes	1,979,598	1,965,146		
Bureau of Home Economics:				
Study of consumer purchases	1,398,855	1,398,855		
Administrative expenses	139,000	35,794		103,206
Total, Bureau of Home Economics	1,537,855	1,434,649		103,206

TABLE 10.—*Detailed statement of emergency funds allocated to Department of Agriculture and of obligations incurred thereunder and from prior-year unobligated balances during the fiscal years 1937 and 1938*—Continued

Appropriation, bureau, and project	1937		1938	
	Allocations	Obligations	Allocations	Obligations
Emergency Relief Appropriation Act of 1936—Cont'd.				
Soil Conservation Service.				
National program of soil conservation, including control operations, erosion surveys, etc	$5,749,924	$5,714,081		
Administrative expenses	78,750	40,825		$37,713
Total, Soil Conservation Service	5,828,674	5,754,906		37,713
Farm Security Administration:				
Rehabilitation loans and grants	99,878,049	99,773,511		
Resettlement projects	14,641,951	14,602,102		
Development of submarginal lands	19,570,581	19,537,660		
Administrative expenses	42,800,000	22,823,763		19,669,263
Total, Farm Security Administration	176,890,581	156,737,036		19,669,263
Total, Emergency Relief Appropriation Act of 1936, Department of Agriculture	227,752,882	206,845,487	$152,800	20,449,888
Emergency Relief Appropriation Act of 1937 (June 29, 1937):				
Office of the Secretary: Departmental reserve			75,700	
Forest Service:				
Surveying, mapping, and boundary tracing of national forests			503,935	501,504
Fire prevention, etc			2,507,017	2,499,232
Control of range-destroying rodents, tree-destroying insects, and tree diseases			528,507	475,201
Range improvements, etc			488,240	486,569
Planting and tree nurseries			2,224,823	2,223,533
Development of camping grounds, national forests			1,351,613	1,292,048
Reconstruction of improvements, etc., damaged by floods in California			107,400	102,348
Administrative expenses			203,500	199,048
Total, Forest Service			7,915,035	7,779,483
Bureau of Entomology and Plant Quarantine:				
Citrus canker eradication			44,934	44,569
Gypsy moth control			1,312,211	1,290,280
Locating and removing peach mosaic			227,760	199,306
Phony peach disease control			105,290	100,865
White-pine blister rust control			1,716,255	1,679,357
Barberry eradication for prevention of black stem rust			1,159,486	1,097,400
Locating and destroying *Thurberia* plants			61,490	60,124
Dutch elm disease eradication			2,870,686	2,803,220
Mormon cricket control			344,750	258,208
Administrative expenses			118,000	123,012
Total, Bureau of Entomology and Plant Quarantine			7,960,862	7,656,341
Bureau of Biological Survey:				
Development of wildlife refuges			1,583,646	1,532,038
Administrative expenses			39,500	38,391
Total, Bureau of Biological Survey			1,623,146	1,570,429
Bureau of Agricultural Economics:				
Survey of farm mortgages, land values, transfers, and farm taxes			191,493	190,726
Administrative expenses in connection with foregoing project			5,000	5,000
Physical improvements, including construction of recreational area, etc			635,001	507,837
Total, Bureau of Agricultural Economics			831,494	703,563

TABLE 10.—*Detailed statement of emergency funds allocated to Department of Agriculture and of obligations incurred thereunder and from prior-year unobligated balances during the fiscal years 1937 and 1938*—Continued

Appropriation, bureau, and project	1937		1938	
	Allocations	Obligations	Allocations	Obligations
Emergency Relief Appropriation Act of 1937—Cont'd.				
Bureau of Home Economics:				
Study of consumer purchases			$481,691	$481,691
Study of body measurements			251,721	231,721
Assays for vitamin content of food			5,500	500
Administrative expenses			203,300	203,300
Total, Bureau of Home Economics			942,212	917,212
Soil Conservation Service:				
National program of soil conservation, including control operations, erosion surveys, etc			2,464,113	2,320,742
Administrative expenses			80,000	73,200
Total, Soil Conservation Service			2,544,113	2,393,942
Farm Security Administration:				
Rehabilitation loans and grants			114,755,000	94,212,082
Resettlement projects			30,731,935	29,319,482
Development of submarginal lands			13,305,538	13,132,831
Administrative expenses			1,315,000	1,283,979
Total, Farm Security Administration			160,107,473	137,948,374
Total, Emergency Relief Appropriation Act of 1937, Department of Agriculture			182,000,035	158,969,344
Grand total, emergency funds	$230,248,728	$263,178,212	182,176,035	179,847,590

RECEIPTS FROM DEPARTMENT'S ACTIVITIES. 1938

Receipts accruing incident to the operations of the Department during the fiscal year 1938 totaled $42,609,446. This amount is classified into two groups, showing (1) miscellanous collections and (2) repayment of loans made by the Farm Security Administration, as follows:

Miscellaneous collections:		
From business on the national forests:		
Timber sales	$2,515,319	
Grazing fees	1,648,010	
All other objects	455,017	
		$4,618,346
Contributions from private cooperators, appropriated as a trust fund (Cooperative Work, Forest Service) for various activities on the national forests and privately owned timberlands		1,072,635
Contributions from private cooperators for expenditure under trust arrangements:		
Farm Security Administration	$6,529,662	
Deposits of fees received from licensees under the Commodity Exchange Act	18,536	
Deposits in part payment of salaries of inspectors under the Sea Food Inspection Act	76,779	
Miscellaneous	32,413	
		6,657,390
From sale of hunting stamps (Migratory Bird Conservation Act)		770,971
From sale of products of migratory-bird refuges, Migratory Bird Conservation Act		61,767
From fees:		
Perishable Agricultural Commodities Act	$198,516	
Alaska game laws	22,577	
Naval stores grading	9,420	
United States Warehouse Act	24,390	
Miscellaneous fees	6,074	
		260,977
Reimbursement for services in inspecting agricultural products, miscellaneous refunds, etc		696,758
Sale of Government property and products, payments for marketing privileges, and miscellaneous services		1,086,574
Miscellaneous		44,719
Total, Miscellaneous collections		15,270,137
Repayments of loans (Farm Security Administration):		
Principal repaid on loans	$26,117,504	
Interest collections on loans	1,221,805	
Total, repayments of loans		27,339,309
Total		42,609,446

DIVISION OF ACCOUNTS

The Department, during the fiscal year 1938, has gradually extended its utilization of the facilities afforded by the regional disbursing offices of the Division of Disbursement of the Treasury Department to effectuate more expeditious payment of the salaries of field employees of the Department. These disbursing offices are now paying semimonthly pay rolls covering the salaries of approximately 42,600 field employees of the various bureaus of the Department. This represents an increase of almost 50 percent over the number paid by these disbursing offices during the preceding fiscal year.

The work performed by the Division of Accounts during the year involved, in addition to the necessary bookkeeping operations, the examination and submission to the central office of the Division of Disbursement, Treasury Department, in Washington, for payment of 663,582 administratively approved vouchers and pay rolls, amounting to $254,132,539, and the examination, recording, and submission to the General Accounting Office of 15,061 claims for settlement, totaling $9,031,890. These figures do not include $46,803,551 in agricultural conservation payments made in Washington for the Northeast, East-Central, and Insular Divisions of the Agricultural Adjustment Administration, under the provisions of the Soil Conservation and Domestic Allotment Act, and adjustment payments under the old agricultural adjustment program, the vouchers for which are not handled by the Division of Accounts.

In this period the Department received from the General Accounting Office nearly 20,000 certificates in settlement of claims transmitted to that Office; also approximately 3,600 notices of exceptions, which were transmitted to the various bureaus of the Department, with copies filed in the Division of Accounts. In addition, 12,192 letters from the General Accounting Office and the bureaus of the Department relating to claims and 8,459 letters relating to check settlements were handled through the Division of Accounts.

To make the necessary disbursing funds available to the chief disbursing officer, Division of Disbursement, Treasury Department, for the payment of vouchers, pay rolls, settlements, etc., and to enable his regional disbursing officers in the continental United States, insular possessions, and territories and the Department's temporary special disbursing agents stationed in foreign countries to make payment of the vouchers and pay rolls scheduled to them, 1,800 requisitions and transfer forms were prepared in or cleared through the Division of Accounts, which placed $834,046,909 to the credit of these officers. This involved the handling through the bookkeeping records of the Division of 42 separate disbursing accounts, subdivided into 218 checking accounts under specific disbursing symbols. The Division received and administratively examined a total of 3,936 disbursing officers' accounts current during the fiscal year, or an average of 318 per month.

During the year the Division of Accounts received 10,837 schedules of collections from the various bureaus of the Department, accompanied by 82,046 remittances in the form of checks, drafts, money orders, and cash, totaling $2,323,390.

In addition to the foregoing schedules of collections, there were handled through the Division 13,576 schedules of adjustments, transfers, and voucher deductions crediting appropriations and funds of the Department, involving a total of $4,384,217.

The Division also recorded during the year allocations aggregating $182,001,035 made to the Department of Agriculture under the Emergency Relief Appropriation Act of 1937, as well as recisions aggregating $32,595,186 from allocations received under the Emergency Relief Appropriation Acts of 1935 and 1936. This required considerable time and effort in clearing with the administrative bureaus and offices of the Department concerned, the Bureau of the Budget, the Treasury Department, and the General Accounting Office. While no general ledger accounts were maintained in connection with the emergency relief allocations, it was necessary to maintain subsidiary records in connection with certain allocations. This was particularly true with respect to administrative funds, the use of which was specifically limited by statute. A complete record and file of all allocations was maintained for the purpose of checking project authorizations, allotments, adjustments, and recisions and for preparing various reports and statements showing the monthly status of such funds.

BUREAU ACCOUNTING SERVICE

This unit has continued the administrative audit and accounting for funds of the Office of the Secretary, Office of the Solicitor, Office of Information, Office of Experiment Stations, Extension Service (including a large volume of work in connection with activities covered by allotments of funds from the Agricultural Adjustment Administration), the Commodity Exchange Administration, and the Bureau of Home Economics.

The accounting for the library was transferred to the Bureau Accounting Service, and the uniform accounting system which had been prescribed by the Acting Comptroller General under date of June 26, 1937, for the library was installed effective as of July 1, 1937. The uniform accounting system for the Office of the Secretary, Office of the Solicitor, and the Office of Experiment Stations was installed during the fiscal year 1937. On July 1, 1937, the Office of Information, Extension Service, Commodity Exchange Administration, and Bureau of Home Economics accounting procedures and allotment records were adjusted to conform to the uniform accounting system. Having completed the installation of the uniform accounting system, consideration is being given to perfecting the control accounting incident to establishing adequate property accountability records.

The work was also greatly augmented by the creation of the Office of Land Use Coordination, increased activities of the Division of Investigation, and the preliminary work incident to the establishment of a uniform procedure for handling sales of photographic reproductions and other items requiring considerable study and planning of the fiscal procedures and accounting methods to insure their adequacy.

A summary of the work of the Bureau Accounting Service is shown in tables 11, 12, and 13.

TABLE 11.—*Auditing, fiscal years 1935–38*

Fiscal year	Claims audited	Purchase orders pre-audited	Contracts audited	Items involved
1935	85,053	6,657	368	1,253,678
1936	93,056	10,492	856	1,189,442
1937	51,446	9,329	429	697,057
1938	41,201	8,860	210	414,542

TABLE 12.—*Record of pay rolls and miscellaneous items, fiscal years 1935–38*

Fiscal year	Pay rolls prepared	Pay-roll items	Letters of authorization written	Collection claims filed	Transportation requests issued	Bills of lading issued
1935	52,901	734,279	7,564	201	7,730	12,078
1936	40,033	591,416	6,994	298	13,874	17,499
1937	24,516	489,423	2,201	305	8,447	4,537
1938	9,564	251,276	1,435	1,361	11,554	2,930

TABLE 13.—*Funds under direct and indirect accounting control of the Bureau Accounting Service, fiscal years 1935–38*

Item	1935	1936	1937	1938
General expense appropriations and transferred funds	$3,235,038	$3,527,687	$4,551,737	$5,394,469
Warranted to States	13,136,096	17,885,000	22,745,014	23,722,583
Offset by States	6,248,258	6,918,636	5,885,014	5,545,623
Supplemental State funds	4,793,374	5,525,653	5,959,276	7,940,276
Allotments from Agricultural Adjustment Administration	23,843,544	15,749,430	3,933,673	2,676,833
Other funds	2,850,332	4,024,054	3,547,026	3,384,288
Total	54,106,642	53,630,460	46,621,740	48,664,072

The decrease for 1938 in the volume of claims audited and pay-roll transactions reported in tables 11 and 12 is due mainly to the adoption by the Agricultural

Adjustment Administration of a plan whereby pay rolling and payment of salaries of field personnel was transferred to regional offices in the field. However, the continued growth of general expense appropriations and transferred funds, together with the steady increase in demands for analytical and budgetary information, has greatly exceeded expectations and made it mandatory that immediate and careful consideration be given to providing adequate facilities for handling the added load.

DIVISION OF PURCHASE, SALES, AND TRAFFIC

The record of business transacted by the Division of Purchase, Sales, and Traffic during the fiscal years 1936, 1937, and 1938 is set out in table 14.

TABLE 14.—*Purchases, sales, and other activities of the Division of Purchase, Sales, and Traffic, fiscal years 1936–38*

Item	1936	1937	1938
Bid section:			
Bid transactions—number	8,816	8,223	6,282
Flow of bids:			
First quarter—percent	20	21	18
Second quarter—do	20	19	17
Third quarter—do	23	25	22
Fourth quarter—do	37	35	43
Bureau purchase orders in excess of $500 approved—number	253	1,735	1,965
Aggregate amount—dollars	314,944	1,928,032	1,312,140
Forest-road contracts examined prior to approval by Secretary—number	78	92	62
Aggregate amount—dollars	4,840,931	6,080,090	4,890,162
Value of property in the District of Columbia transferred from one bureau to another in Department—dollars	11,107	3,654	11,027
Initial value of worn out property transferred to Procurement Division, Treasury Department—dollars	56,036	31,034	87,827
Traffic Section:			
Freight routings furnished:			
Less than carload—number	17,735	13,489	11,629
Carload—do	3,097	2,941	1,892
Express routings furnished—do	10,508	8,946	6,117
Rates furnished:			
Freight—do	62,985	83,952	36,882
Express—do	626	3,506	1,357
Passenger, rail and water—do	9,579	6,860	10,595
Parcel post—do	132	1,189	726
Air, passenger—do	240	114	302
Itineraries furnished—do	1,872	2,267	5,517
Central Supply Section:			
Stock issues during year—dollars	923,491	866,488	710,226
Requisitions for stores, filled—number	40,300	43,353	38,909
Requisitions for printed forms, filled—do	[1] 23,000	[1] 25,000	[1] 28,000
Purchase orders (both to maintain stocks and for other activities)—number	41,044	39,340	20,450
Money value involved, all purchase orders—dollars	14,076,503	8,609,897	5,486,892
Average money value per purchase order—do	343	218	267
Experimental byproducts sold: For deposit to miscellaneous receipts—dollars	32,861	46,553	48,153

[1] Estimated.

BID TRANSACTIONS

Several of the bureaus, notably the Soil Conservation Service, availed themselves in larger measure of their authorizations to make field acceptances of bureau-solicited proposals. This naturally reduced to some extent the number of contracts for supplies and equipment, special services, and construction work negotiated by the Division, with a comparable decrease in the total value of these contracts; the figures for the year being 6,282 contracts, aggregating approximately $9,300,000—an average value per contract of $1,480. The demands upon the Bid Section were particularly heavy, however, during the last quarter of the year. In this period were negotiated 43 percent of the contracts for the entire year, and considerably more than half of these last-quarter contracts were negotiated during the final month of the year.

Under the Public Contracts Act of June 30, 1936 (49 Stat. 2036), commonly referred to as the Walsh-Healey Act, the Secretary of Labor will determine the prevailing minimum wages for the various industries, and when such determinations are made contractors in the specific industries involved must pay not less than such minimum wages in the performance of any contracts with the United

States falling within the purview of the act. In this connection pertinent information must therefore be included in advertisements which may develop contracts subject to the stipulations of the act. During the year 17 such determinations were made, but for the most part they covered industries producing articles and supplies in which the Department is not usually interested directly as a contracting agency. As further determinations are made, however, the specifications of the Department must of necessity increasingly reflect wage requirements under the act. Obviously this will introduce a greater complexity in the work of preparing supplies specifications.

During the year, also, the Acting Comptroller General prescribed as a condition precedent to the acceptance of vendors' invoices or public vouchers for purchases and services other than personal the execution thereon of various certifications in addition to those which have heretofore been required. The work of procurement officers will be further complicated thereby by reason of the fact that in each instance, before advertising a requirement, it will be necessary to determine which of the various certificates are applicable, and to include appropriate reference thereto in the advertising in order that prospective vendors may have advance notice of the exact form in which their accounts must be rendered.

In the report for the fiscal year 1937 reference was made to the requirements of the Agricultural Adjustment Administration and the Soil Conservation Service for aerial surveys and to the steps which had already been taken for general coordination of this work for the Government as a whole. It having been found that the general specifications prepared and prescribed by the Procurement Division of the Treasury Department were not in their entirety suited to the needs of the Department of Agriculture, revised specifications were prepared by a department committee and, after approval by the Procurement Division, were placed in use. Under these revised specifications 43 contracts for aerial photography were negotiated by the Division during the year. These contracts aggregated, with amending increases, $1,581,026.52. Comparative statistical data recently compiled by the special technical assistant, Office of the Secretary, indicate that, through the use of the new specifications, the preparation and distribution to prospective bidders of special meteorological charts showing flying-weather expectancy in various sections of the country, and the planning and scheduling of projects based upon the best periods shown by these charts, the Department has effected a saving of at least $400,000 in its aerial survey bills for 1938.

The Federal Crop Insurance Corporation, created by title V of the Agricultural Adjustment Act of 1938, approved February 1938, as an agency within the Department of Agriculture, has designated the Central Supply Section as its procurement and supply organization and hereafter will be served in the same manner as other subscribing organizations of the Department.

PROPERTY LISTS

The uniform classification of items of property for all bureaus, as provided for in the General Regulations of the Department, was continued during the year. Substantially all bureaus have now submitted property lists for classification under the new regulations and classification work is nearing completion. Classifications already approved are being currently maintained, both as to changes in classification based upon showings made by the bureau and through submission of supplemental lists covering items not theretofore classified.

COORDINATION AND CONTACT WORK

In addition to the coordination and contact work referred to in the report of last year, which work has continued in all of its essential phases during the fiscal year 1938, the Chief of the Division has been designated by the President as the Department of Agriculture representative on the Committee on Purchases of Blind-Made Products created by the act of June 25, 1938 (52 Stat. 1196), and the Associate Chief of the Division has been selected by the Department's Advisory Committee on Photogrammetry to serve as a member of its Subcommittee on Specifications and Contracts for Aerial Photography.

GENERAL SURVEY OF PROCUREMENT AND SUPPLY WORK

Within the past few years not only has the general scope of the Department's activities been greatly expanded by the acquisition of two major organization units—the Soil Conservation Service and the Farm Security Administration—but the emergency conditions which have obtained generally have occasioned an

extraordinary expansion of duties and responsibilities in all lines of Department work. Administrative officials have realized that under the stress of this period it has not been possible, without some sacrifice of main objectives, economically to maintain at their proper standards of efficiency such collateral but important services as procurement and supply. During the past year, however, when stabilization of conditions appeared to be taking form, it was determined that the time had arrived for a careful review of existing administrative procedures and facilities in the field of procurement and supply in order that all operating mechanisms in this field might be so coordinated as to provide the greatest possible return in the matter of efficient and effective service.

The problem was approached by undertaking a fact-finding survey of existing purchasing, storeroom, and warehouse operations, and, to insure that the information developed would be representative of all types of procurement and supply work, all procurement offices in Washington, a majority of the regional procurement offices and warehouses, and a few scattered lesser organizations were covered. Separate reports were prepared to cover the individual offices visited, and from these a summary report in which all like information was assembled in tabular and graphic form. These reports will now be studied by administrative officers, and it is believed that upon them it will be possible to predicate a procedure which, for the Department as a whole, will produce results in the service of supply field which will embody maximum economy consistent with required efficiency.

CHANGES IN DEPARTMENT REGULATIONS

During the year the following amendments to the regulations of the Department were approved by the Secretary:

Amendment No.	Title	Regulation affected No.
32	Periodical Inspection of Field Offices and Stations	2911
33	Misconduct, Neglect of Duty, or Irregularities	2921
34	Distribution and Use of Reports	2922
35	Suspension From Duty Without Pay During Investigation and for Other Reasons	2923
36	Misconduct	2814
	Suspension During Investigations	2815
37	Notification of Contemplated Visit	1821
38	Claims for Private Property Lost or Damaged Through Negligence of Employees	3162
40	Performance Bonds	3143
	Payment Bonds	3144
41	Selections from Certificates	2124
42	Recommendation for Appointment	2125
43	Selections from Certificates	2146
44	Questionnaires, Circular Letters, etc	1611
45	Questionnaires, Circular Letters, etc	1616
46	Telegrams	1681
	Procedure in Washington	1682
	Radiograms and Cables	1683
47	Advances of Public Moneys	3182
48	Examination and Certification of Accounts	3113
49	Purchases of Foreign Materials	3341
50	Liquidated Damages and Time of Delivery	3319
51	Final Salary Payment	3213
52	Property Not to be Given as Payment for Supplies	4121
53	Appearances, Fees, and Expenses of Department Employees as Witnesses in Judicial Proceedings	1522
54	Listing of Field Offices or Stations in Telephone and City Directories	1675
55	Membership in Military or Naval Organizations	1573
56	Construction of Buildings	1713
57	Bonding of Employees Receiving or Having Custody of Official Funds	3142
58	Confidential Information	1544
59	Insured Mail	1643
60	Agencies of the Department	1111
61	Operation and Servicing of Motor Vehicles in the District of Columbia	1838
62	Former Employees Acting as Agents or Attorneys	1579

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REPORT OF THE CHIEF OF THE FOOD AND DRUG ADMINISTRATION, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
FOOD AND DRUG ADMINISTRATION,
Washington, D. C., August 30, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith the report of the Food and Drug Administration for the fiscal year ended June 30, 1938.

Sincerely yours,

W. G. CAMPBELL, *Chief.*

CONTENTS

	Page
Food, Drug, and Cosmetic Act	1
Food and Drugs Act of June 30, 1906	2
Enforcement statistics	2
Time spent on different types of violation	3
Food adulterations involving public health	3
Food adulterations involving filth and decomposition	8
Food adulterations involving economic cheats	12
McNary-Mapes amendment	12
Sea-food amendment	13
Actions on drugs	13
Bacteriological studies of foods and drugs	15
Vitamin tests	16
Pharmacological investigations	16
Development of new analytical methods	17
Comments on court cases	18
Insecticide Act	20
Agricultural insecticides and fungicides	20
Household insecticides	21
Insecticides for use on animals	21
Analytical methods for insecticides	22
Bacteriological testing methods for disinfectants and antiseptics	22
Caustic Poison Act	22
Import Milk Act	22
Tea Act	23
Filled Milk Act	23
Naval Stores Act	23
Regulatory work	23
Service work	23
Color-measurement work	24
Rosin standards	24
Certification of coal-tar colors	24
Collaboration with and service for governmental agencies	24

FOOD, DRUG, AND COSMETIC ACT

The Federal Food, Drug, and Cosmetic Act, passed in the closing days of the Seventy-fifth Congress, was approved by the President on June 25, 1938. Almost exactly 5 years before, on June 12, 1933, the first bill proposing a complete revision of the Food and Drugs Act of June 30, 1906, was introduced in the Seventy-third Congress. Five years of legislative consideration have produced a measure that will unquestionably afford greatly increased public protection even if it does not contain all of the provisions its advocates have urged. The new law becomes completely effective on June 25, 1939. Sections designed to protect the consumer against dangerous drugs and cosmetics went into effect on the date of approval.

The new law retains the valuable features of the old statute, eliminates many technicalities that prevented efficient enforcement, provides penalties more nearly commensurate with the gravity of offenses, affords additional and more effective methods of control of adulterated and misbranded foods and drugs, and for the first time brings cosmetics within the scope of Federal regulation. The annual reports of this Administration for 1931 and 1933 outlined the recommendations that have been made repeatedly during the last 20 years for legislative improvements in the existing law. The new measure embodies most of these recommendations in its many new provisions.

The measure was approved practically at the close of the fiscal year. The Administration at once began the formulation of regulations for the enforcement of the new law. Preparations for legal actions under the immediately effective sections against dangerous cosmetics, typified by poisonous eyelash dyes, were also instantly begun.

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FOOD AND DRUGS ACT OF JUNE 30, 1906

ENFORCEMENT STATISTICS

The fiscal year 1938 was the last complete year of enforcement for this 32-year-old statute. The law will remain in force during the greater part of 1938–39 but is repealed by the Food, Drug, and Cosmetic Act on June 25, 1939. During the year 1,200 notices of judgment recording actions terminated in the courts under the act, and numbered serially from 26726 to 27925, were issued. These notices covered 2,670 shipments alleged to have been in violation of the statute.

Tables 1, 2, and 3 contain the usual data relating to seizures and criminal prosecutions, import actions, and samples collected and examined.

TABLE 1.—*Summary of interstate samples on which criminal prosecutions and seizures were based during the fiscal years 1937 and 1938*

Item	Criminal prosecutions		Seizures		Total	
	1937	1938	1937	1938	1937	1938
Foods	590	330	1,061	1,538	1,651	1,868
Drugs	350	360	263	446	613	806
Stock feeds	20	36	5	8	25	44
Total	960	726	1,329	1,992	2,289	2,718

TABLE 2.—*Import shipments inspected at port laboratories during 1937 and 1938*

Item	Inspected and refused entry		Inspected and released		Total	
	1937	1938	1937	1938	1937	1938
Foods	1,975	1,763	25,540	27,478	27,515	29,241
Drugs	1,359	1,218	6,347	4,107	7,706	5,325
Total	3,334	2,981	31,887	31,585	35,221	34,566

TABLE 3.—*Number and kind of shipments inspected or sampled in 1937 and 1938*

Item	1937	1938	Item	1937	1938
Foods:			Drugs:		
Interstate samples	11,755	17,001	Interstate samples	7,024	9,354
Investigational samples	9,082	6,851	Investigational samples	512	353
Import shipments	27,515	29,241	Import shipments	7,706	5,325
Total	48,352	53,093	Total	15,242	15,032
			Total foods and drugs	63,594	68,125

The figures in the column in table 1 headed "Criminal prosecutions" represent the number of samples from interstate shipments alleged to have been in violation and referred to the Solicitor of the Department as bases for criminal prosecutions of the responsible distributors. The Administration and the Solicitor make every effort to expedite the preparation of cases to insure that they will be filed in the proper Federal court in the shortest possible time after the offense has been committed. Inevitable delays in the termination of cases frequently occur after filing because of the congestion of dockets in some jurisdictions, and time-consuming legal proceedings. This accounts in part for the fact that there is no observable relationship between the number of notices of judgment covering terminated cases issued in any year and the number of shipments reported as

bases for legal actions. A further reason for this lies in the fact that in many instances a number of alleged offenses by the same shipper are consolidated in one court action.

Attention was given to the output of 13,315 manufacturers and shippers located in the United States. Approximately 3,300 of these were responsible for some form of adulteration or misbranding. The figures in table 3 do not include inspection of about 254,000 cans of cream for butter-making, sampled from interstate and intrastate sources in cooperation with State and municipal officials; nor do they include the samples taken from 900 tons of condimental seeds imported for oil pressing. The import inspections recorded in tables 2 and 3 include some 18,000 shipments given only sufficient attention to determine that no extensive sampling and chemical analysis was required.

TIME SPENT ON DIFFERENT TYPES OF VIOLATION

In 1938, 86.7 percent of the time of the food and drug force was occupied with the control of interstate traffic, and 13.3 percent with import traffic, as compared with 84.9 and 15.1 percent, respectively, in 1937. The decrease in time given to import activities is attributable to a reduction in importations of foods and drugs late in the year due, no doubt, to disordered conditions abroad.

Thirty-three percent of the field time was utilized on the drug project as compared with 29.4 percent in 1937. This was caused by the necessity of temporarily diverting a large part of the field force to the drug project because of the catastrophies growing out of the distribution of poisonous "Elixir Sulfanilamide" and "cancer serum."

In 1938, 14.8 percent of time was given to the fruit project as compared with 19 percent in 1937 and the preceding year. Supervision of fruit for spray residue was maintained at the normal rate, but decreased attention was given such manufactured fruit products as are subject to economic types of violation. Vegetable products required 8 percent of the time of the field force as compared with 12 percent in 1937. Fisheries products, including shellfish, required 6.9 percent as compared with 9.1 percent in 1937. There is reflected in this reduction continued improvement in the quality of the salmon pack and the reduced attention necessarily given to canned shrimp because of Federal inspection under the sea-food amendment to the Food and Drugs Act in most shrimp-packing establishments. Dairy products required 7.9 percent of the field time as compared with 8.9 percent in 1937. The remainder of the working time was divided as conditions required among the many classes of food products that invariably require some attention. Included among these are beverage products and flavors, cereals, chocolate and cocoa, coffee and tea, eggs, nuts, oils and fats, confectionery, spices and condiments, mineral waters, and stock feeds. For reasons that will be later explained it was necessary to give increased attention to flavors, cereals, and confectionery and this is reflected in the following comparative figures. Four and six-tenths percent of the field time was utilized for flavors in 1938, and 0.4 percent in 1937; for cereals 3.5 percent in 1938, and 2.3 in 1937; for confectionery 4.7 percent in 1938, and 1.9 in 1937.

FOOD ADULTERATIONS INVOLVING PUBLIC HEALTH

Two hundred and ninety-seven seizures of fruits and vegetables bearing excessive spray residues were made as compared with 125 in 1937. These actions were distributed as follows:

	Seizures		*Seizures*
Apples	251	Pears	14
Cherries	3	Plums	1
Crab apples	16	Quinces	1
Currants	6	Cauliflower	5

Seizures of apples for excessive spray residues amounted to 299 in 1935, 106 in 1936, and 87 in 1937. There was thus an upward swing during the year in the number of such actions. This was due largely to crop increases rather than to a diminution of the corrective measures applied by the industry. One eastern State, however, which heretofore had maintained a reasonable effective supervision over its spraying practices temporarily lost control of the situation. Certain growers sprayed much later than was recommended by the State entomologists and refused to incur the cost of washing because of the low market price of the fruit. As a result, 69 seizures were made of shipments from this State alone, only 9 of these exceeding 100 bushels in size. No doubt because of these actions, later shipments from this State were within the tolerance.

With the exception of this temporary condition in one eastern State, the proportion of high-residue fruit moving in interstate commerce continues low and has not materially changed since last year. In fact, there was a more general adoption of the washing process in many sections, and States that have heretofore required concentrated attention because of backwardness in the adoption of effective programs of spray-residue supervision installed control measures.

The Administration's laboratories analyzed 5,465 samples of apples, representing the output of 3,814 distributors. In 1937 analysis was made of 3,701 samples, representing 2,373 distributors. The increase in sample collections reflects the increase in the crop. While records are incomplete, definite information is available that the authorities of the various apple-producing States collected more than 90,000 samples of fruit, principally apples, for analysis for spray residue.

The annual report for 1936 stated: "Interstate traffic in sprayed fruits and vegetables no longer presents a public-health hazard. It must be stated emphatically, however, that the traffic will again become a public-health hazard unless there is a continuation and, when needed, an extension of the rigid control now exercised in producing areas. While there is no basis whatever for an alarmist view, any disposition to deny the necessity of adequate cleansing on the ground that spray residues cannot possibly be dangerous is equally baseless. The sane and constructive view of the majority of the fruit-producing industry and of responsible State authorities recognizes that until some satisfactory substitute for poison sprays is discovered, continued precautionary measures alone will guarantee public protection and warrant public confidence."

This statement is equally true today. Its repetition may be timely. While there was no extensive neglect of those precautions essential for holding spray residues below a safe tolerance, certain sections are manifesting an unmistakably impatient attitude at the necessity of using drastic washing processes before marketing heavily sprayed apples. Fruit producers who have followed the advice of competent entomologists in the employment of sanitary clean-up measures and of carefully planned and moderate spray schedules, have had little difficulty in producing clean fruit well within the spray-residue tolerance with a minimum washing treatment that has caused no serious damage to the fruit. Limited sections, however, have endeavored to control codling moth infestation by ever-increasing applications of lead arsenate and fluorine sprays, complicated by the employment of adhesives that have left the fruit at harvest heavily coated with spray residue. The heroic cleansing treatment necessary to bring such fruit within safe tolerances has inevitably damaged the storage quality of the fruit. These areas have demanded a relaxation of the spray tolerances to permit them to market fruit without subjecting it to drastic washing operations.

Existing spray-residue tolerances are based on the best technical advice obtainable by the Department. By an act of Congress the duty of investigating the toxic effects of spray residues has been assigned to the Public Health Service. Unless or until that agency develops scientific evidence that the tolerance may be safely relaxed, it is the obvious duty of the Department to continue to enforce its present tolerances. It would be unfortunate indeed if opposition in one section of the apple industry against the adoption of those precautions necessary to insure compliance with the tolerances should again create justifiable suspicion about the safety of commercial apples after so many years of constructive effort on the part of the industry to produce fruit that will merit public confidence.

The normal amount of attention was given to other fruits and to vegetables that might bear excessive spray residues. The figures given above show that contamination of these products was relatively rare. No contamination involving interstate products was observed in the case of cabbage, chili peppers, green peppers, celery, and lettuce, which have caused concern in previous years. The five cauliflower seizures listed all originated in one section of the Northwest and resulted in further action by the State officials who destroyed the remainder of the contaminated crop at its source. In one instance, authorities in another western State required that a crop of excessively sprayed cauliflower be plowed under. In a third western State, a lettuce crop bearing residues of fluorine as high in some instances as 1.22 grains per pound was required to be cleaned by drastic stripping of the outside leaves before shipment. Interstate shipments so treated were examined by the Administration's chemists and found to be clean.

The problem of metallic contamination, particularly with lead from nonspray sources, continues to require attention. Last year's report recorded the fact that 81 importations of sardines were analyzed and 18 lots, totaling 3,700 cases, were detained because of the presence of excessive lead. During 1938, 229 lots of canned sardines were examined, of which 18 were refused entry for the same reason. There has been a general adoption by foreign packers of crimped tins in place of the old-style soldered tins. However, even in the new-style tins an occasional lot may be encountered containing high lead due no doubt to contamination from other lead-bearing surfaces or equipment in the course of canning. Ten lots of imported canned tuna and one small consignment of anchovies were also refused entry because of excessive lead content.

Last year's annual report described the educational efforts undertaken in cooperation with State authorities to impress maple-sirup producers with the necessity of discontinuing the use of lead-bearing equipment and utensils. While much progress in this direction was made, continued supervision over interstate and import traffic in maple products was necessary. During 1938, the plan of operation provided for sampling at shipping points after assembly of carload lots and delivery for shipment. Three hundred official samples of maple products were examined, resulting in 22 seizures, aggregating 1,089 drums valued at $60,280. Ninety-five import lots amounting to almost 5 million pounds of maple sugar were examined, of which 41 lots, totaling 2,600,000 pounds, were refused entry for food purposes. While intended for immediate consumer protection, these operations have had the additional effect of hastening fundamental corrections. As evidence of progress toward this end, the large centralizers throughout the season made independent examinations of their own receipts and segregated for deleading even such lots as had not yet been formally libeled. Impressed by the expense of this method of handling, some of the centralizers are reported to be considering inspection at the source so as to eliminate from subsequent interstate traffic all lots containing excessive lead.

In the course of its routine inspection operations, the Denver station discovered one confectionery product containing surprising quantities of lead amounting to as high as 0.07 grain per pound. The product was removed from the market and investigations are being made in an attempt to find the source of the contamination.

Three consignments of apple butter containing excessive lead were also libeled. While excessive lead in apple butter is usually attributable to spray residue, one of these seizures owed its lead contamination to lead solder in utensils and equipment employed in the manufacturing plant.

An inexcusable type of metallic contamination was encountered in a consignment of chili sauce manufactured by an eastern producer. Consumer complaints were received that the product appeared to contain steel shavings. Sample collections demonstrated the presence in five out of a dozen bottles examined of sharp pieces of metal. The small shipment represented by this sample was seized. At the same time the plant was visited to ascertain what further distributions had been made and determine the cause of the contamination. It was found that the manufacturer, to complete the pack of chili sauce, had purchased canned tomatoes in No. 10 tins. When these cans were opened with a power opener, faulty operation resulted in shavings of metal dropping unnoticed into the tomatoes that were later used in batches of chili sauce. The firm immediately withdrew all outstanding stocks from the market.

As in previous years, the Baltimore, Atlanta, and New Orleans stations devoted considerable time to the supervision of plants packing cooked crab meat. The first two stations employed the trailer laboratory with full bacteriological equipment for the examination of samples in the field. Operations in Atlanta station's territory were conducted in Florida during February and in Georgia, North Carolina, and South Carolina in April. During July and August, Maryland and Virginia packers were given attention. While scarcity of crabs reduced the amount of interstate traffic in the States within the territory of the Atlanta station, sanitary conditions in many of the plants inspected were better. Objectionable conditions still prevailed, however, in some plants. The Baltimore station's survey showed improvement in sanitary conditions in the plants in Virginia. While some of the Maryland plants likewise showed improvement, too many continued to operate under thoroughly insanitary conditions. Most of the plants in the New Orleans territory showed improvement in sanitation.

By the adoption of a more selective sampling procedure, attention was given in these three station territories to the output of 136 packers whose sanitary practices were open to question. This resulted in 45 seizures directed against the products of 23 packers. In 1937, 164 packers were given attention with 106 seizures from the output of 48 firms. Criminal prosecutions were instituted against 10 shippers in 1938 as against 8 in 1937. While conditions in this industry are improving, those elements that have ignored the essential sanitary precautions must obviously be subjected to the most drastic penalties provided by the law.

The "Elixir Sulfanilamide" tragedy, which will be discussed in a later section, forcibly directed attention to the possibility of danger in the use of diethylene glycol and related solvents as an alcohol substitute in the manufacture of flavoring extracts. For a number of years this Administration has advised prospective users of these substances against their employment in foods on the ground that insufficient data had been accumulated on which to base a definite conclusion as to their safety. It is now definitely known that diethylene glycol is highly toxic to human beings. While flavoring extracts are usually materially diluted before consumption, their employment for food purposes in quantities comparable to those that proved poisonous in the "Elixir Sulfanilamide" episode is by no means impossible. Every consideration of public-health protection dictated the removal of diethylene glycol and similar solvents from the food-flavoring field. Investigation showed that diethylene glycol, diethylene-glycol-mono-ethyl-ether, and mixtures of these chemicals were being extensively sold for use in the manufacture of flavors. Their solvent properties and high boiling points commended them for this purpose in that they would not "bake out" or "freeze out" in use. It was ascertained that all of the solvents going into food channels originated with one manufacturer. The flavoring-supply houses received the solvents from this one source and in turn resold them under trade names to manufacturers of flavors, or themselves incorporated them in flavoring products. Seizure was initiated not only against shipments for food use of the solvents themselves, which were found on the market in lots varying from a few pounds up to drums of 350 to 500 pounds capacity, but also against extracts and flavors manufactured with the use of these solvents. Manufactured products included lemon, orange, and imitation vanilla flavors, diverse fruit flavors for use in the manufacture of candy, imitation liquor flavors of various kinds, imitation flavors for use in soft drinks, imitation butter flavors, and the like. In the course of the campaign 103 consignments of the solvents and 104 shipments of flavors containing them were seized. As a result of these actions the manufacturer of the solvents and the primary distributors recalled stocks not yet seized, and discontinued the use of diethylene glycol and diethylene-glycol-mono-ethyl-ether as solvents for food use. Within a few months stocks of these solvents for food use and all food products containing them disappeared from the market.

FOOD POISONING

Seventy-six suspected food-poisoning cases were investigated. This is approximately the number given attention in each of the 3 preceding years. Such reported cases are invariably studied with sufficient care to ascertain whether a food product subject to the Food and Drugs Act is incriminated. In many cases city or State officials participate in the investigations. Samples of the suspected causative agents are procured where possible for laboratory examination. Only 34 samples were obtainable in connection with the 76 cases investigated but only 7 yielded positive laboratory findings, 6 showing toxigenic staphylococci and 1 type A *Clostridium botulinum*.

In 34 of the alleged cases no evidence confirming the suspicion of food poisoning could be obtained. For the most part the symptoms in these cases were of temporary indisposition, affecting from three to seven in a family.

In 23 cases the symptoms were so definitely those of gastroenteritis and the epidemiological evidence so convincing as to warrant the conclusion that they were actually attributable to contaminated food. Fourteen samples of foods examined in connection with these cases, six by the Administration's laboratories and eight by State or municipal laboratories, disclosed the presence of hemolytic staphylococci capable of producing a potent toxin. The foods represented by these 14 samples were eclairs, cream pies, cooked ham, broccoli with hollandaise sauce, and bottled raw carrot juice. Two cases authenticated

more by epidemiological evidence than by laboratory findings were apparently due to imported cheese on which an embargo was placed by city officials. In 7 of the 23 accepted food-poisoning cases no samples could be collected but the products that were incriminated on inspectional evidence were salads, left-over meats, stew, cold fish, and salad dressing, all of which may support the growth of food-poisoning organisms if not properly handled and stored.

Several of these 23 outbreaks involved large numbers of people, perhaps the most extensive being that which occurred in Washington, D. C., and vicinity following the consumption of cream-filled eclairs distributed by bakery wagons. In that occurrence several hundred persons were affected. In other outbreaks occurring at institutions, clubs, and churches the number of victims ranged from 25 to 150 or more; several apparently well-authenticated cases, on the other hand, involved only small family groups. In general, these outbreaks were not attributable to products subject to the Food and Drugs Act. The Washington incident, however, led to prosecution.

Eleven of the cases investigated were alleged outbreaks of botulism. Six of these, accepted as authentic, were due to underprocessed home-canned foods, namely, green beans, chili peppers, asparagus, and greens. Fatalities occurred in all six outbreaks. Samples from two botulism outbreaks were submitted to the Administration. Those obtained from the spectacular outbreak at Tucumcari, N. Mex., in which several deaths occurred, yielded type A *Clostridium botulinum.* The product involved was home-canned chili peppers. The other sample obtained by the Administration did not represent the material actually consumed and did not contain C. *botulinum* or its toxin. One case reported as botulism occurred on a mink farm in Colorado. The diagnosis of botulism in 4 of the the 11 cases recorded is open to doubt since the symptoms were vague and not typical of this type of food poisoning. No fatalities resulted in these cases. During the year there was no proven case of botulism due to commercially canned food.

Three cases investigated were suspected of being caused by chemical contamination of food, although in two of them no laboratory evidence to support such a conclusion could be obtained. The third case, in which some evidence was acquired that fluoride had been added to the food, was handled by local authorities.

As usual, some cases reported as food poisoning were found to be due to other causes. One turned out actually to be an acute kidney ailment, three were quite definitely cases of carbon monoxide poisoning, and the symptoms in one case were probably those of an allergic reaction.

The most significant observation during the year's experience with bacterial food poisoning concerns the frequency with which toxigenic cocci may occur and the variety of foods which may become toxic because of their presence. This type of micro-organism, previously found in cream-filled pastries, has also been found to produce toxin in other foods, held over in the home or restaurant, notably ham and certain food sauces. It is apparent that these organisms recognized as causes of food poisoning only in comparatively recent years are extremely important factors for consideration in any program for the prevention of illness following the consumption of food.

Reference is made above to a food-poisoning outbreak in and near Washington, attributed to cream-filled eclairs. Factory inspection in this instance demonstrated that insanitary conditions prevailed in the plant and bacteriological examination definitely established that the eclairs were the responsible agent. Criminal prosecution was initiated against the corporation and its responsible officer. A plea of guilty was entered on behalf of the corporation and the individual defendant. A fine of $200 was imposed on the corporation, and $200, or 60 days in jail, on the individual. The court, however, suspended the execution of sentence presumably because the corporation itself had gone into bankruptcy as a result of the poisoning outbreak and had discontinued business.

This Administration has alluded in earlier reports to the frequency of poisoning through carelessness in the storage of insecticidal poisons in the home. Products like lead and calcium arsenates and sodium fluoride may readily be mistaken for flour or other similar white, powdered foods. Such mistakes have caused innumerable cases of poisoning, many of them fatal. It has become a routine practice for the Administration to issue warnings against carelessness in the storage of such products in the kitchen or in any place where they can be reached by small children. During the year, manufacturers of white

arsenates such as calcium and lead, have voluntarily agreed to add a distinctive pink color to these poisons as a safety measure. This action on the part of manufacturers is praiseworthy and should be very helpful in preventing future tragic mistakes in confusing these insecticides with food materials. It is to be hoped that manufacturers of other poisons that may easily be confused with foods will eventually adopt a similar precaution.

A complaint of illness from the consumption of tea made in cups with a colored glaze led to an investigation of the pottery in question. It was found that tea with added lemon juice dissolved from 15 to 25 parts per million of lead from these cups, besides an amount of copper sufficient to affect the color and flavor of the beverage. While the Food and Drugs Act provides no direct jurisdiction over this condition, the matter was taken up with the organized ceramic industry with the result that immediate steps were taken to adopt a form of glaze that would be free from objection on this ground. The comparatively recent vogue of brightly colored dishes and the apparently sporadic occurrence of glazes high in lead indicate that food contamination from this source has not been prolonged nor extensive. It seems likely that the illness in this instance was attributable to copper rather than lead.

FOOD ADULTERATIONS INVOLVING FILTH AND DECOMPOSITION

More than 254,000 cans of cream for butter making from intrastate and interstate sources, were examined by State and Federal offices. Six thousand nine hundred and fifty-seven cans were condemned. The contents of the individual cans inspected averaged approximately 8 gallons. In 1937, 192,000 cans were inspected with condemnation of 5,410 cans. There was a material increase in the number of creameries given attention and the number of containers of cream examined, with a corresponding increase in the number condemned but a small decrease in the percentage of condemnations. The percentage of condemnations has decreased slightly each year since the project on cream for butter-making purposes was inaugurated, notwithstanding the fact that experience acquired by the inspectors in finding bad cream has increased. Although improvement has occurred, conditions in the industry on the whole are far from ideal. While those areas that produce a great deal of sweet cream with frequent deliveries are subject to very little criticism, the sections that rely on sour cream for butter-making purposes leave much to be desired, particularly in the summer months. Extensive changes in the methods of procurement and handling are essential before this industry can be said to be in a thoroughly satisfactory condition.

Other dairy products given attention include seven consignments of Limburger cheese and four of butter, all found to be filthy. Twenty-one seizures of filthy butter were made in 1937.

Tomato products received the usual supervision to assure freedom from decomposed or insect-infested material. Thirteen consignments of catchup were libeled because of the presence of insect fragments or mold as compared with 39 shipments seized in 1937. Ten lots of puree made from moldy tomatoes were seized as compared with 27 in 1937. Eight seizures of tomato paste likewise adulterated with insect fragments or mold were accomplished as compared with 43 in 1937. In general, conditions in this industry were good in most of the important producing areas. The weather during the growing season was particularly favorable to the production of satisfactory products. Attention was given by the field stations to 314 manufacturers of tomato products other than canned tomatoes, with examination of 1,167 samples resulting as stated in 31 seizures and 13 criminal prosecutions on the basis of filth or decomposition. The contrasting figures for 1937 were as follows: 2,011 samples examined, representing the output of 387 manufacturers; 140 consignments seized because of filth or decomposition; and 16 criminal prosecutions initiated.

The year's production of canned salmon amounted to about 7½ million cases. As usual, inspectors were assigned to the three packing districts in Alaska and to the Washington State and Columbia River sections. The output of 146 manufacturers was given attention through 273 factory inspections and examination of 1,067 samples. It was unnecessary to direct any action against the 1937 pack. While a material part of the improvement in the quality of salmon may be attributed to the efforts of the canners in correcting packing conditions, compelling more prompt and frequent delivery by fishermen and

cutting down the time between delivery and processing, these efforts were obviously favored by good weather and temperature conditions during the packing season. The pack was lighter than in the previous year, and the season was not characterized by periods of warm weather which further decomposition.

Tuna canning in the continental United States has heretofore been confined to southern California. During the past year substantial tuna runs were encountered off the Oregon coast and some packing of tuna from those waters was carried on in the Columbia River vicinity although some part of the catch was shipped to southern-California canneries. The Northwest run was of the albacore variety and represents very nearly all of the albacore caught by American vessels for canning purposes. Recent tuna runs have been reported in eastern waters and are now the subject of investigation by eastern canners. There are 20 tuna canneries in the United States. All of these were repeatedly inspected and 372 samples were examined principally from outgoing shipments. Seven shipments were seized and one criminal prosecution was instituted.

Most of the tuna packed in California is caught in waters far distant from the coast of the United States. While a considerable quantity of the Mexican and Central American catch has an import status, much of it continues to be delivered from American vessels and is classified as of domestic origin. Fishing is carried on on the tuna banks as far south as the coast of Ecuador in South America. Importations from other than South and Central American countries are entirely from Japan. Approximately 147 lots of raw tuna, totaling nearly 13 million pounds, were offered for entry for canning purposes and all were detained for conditional entry. Conditional entry is necessary because the tuna is usually received in a hard-frozen condition that prevents inspection until the product is thawed and cooked. The California State Board of Health maintains compulsory cannery-inspection service, requiring all fish canneries to operate under the general supervision of State inspectors. Imported lots are not released until the canned product has been examined by both the State cannery-inspection service and the Food and Drug Administration and found to be free from decomposition.

One hundred and thirty-two lots of imported canned tuna, totaling 876,000 pounds, were offered for entry, and 27 lots, amounting to 160,000 pounds, were detained. As has been previously noted, a portion was detained because of the presence of lead; the remainder of the detained lots contained partly decomposed fish in the cans.

In spite of extensive attention, no action against domestic canned mackerel and sardines was found necessary, thus repeating the experience of last year.

Importations of tullibees and whitefish infested with parasitic worms demanded continuous attention at the Canadian port laboratories of the eastern and central districts. One thousand eight-hundred and twenty-two lots of imported Canadian fish were examined, aggregating 8,763,000 pounds, and 182 lots, totaling 426,000 pounds, were detained because of parasitic infestation. Last year 1,617 lots, totaling 8,695,000 pounds, were examined, and 174 lots, totaling 798,000 pounds, were detained. On the basis of the percentage by weight rejected, an improvement has occurred as compared with last year. The supervision of imported tullibees and whitefish for parasitic infestation presents many difficulties. Last year's report referred to the trickery practiced through the adoption of bootleg methods to circumvent inspection. Importers continue to use various subterfuges for this purpose such as "facing" truck loads, as well as individual boxes, with fish known to be free from parasites; false invoicing as to the contents of the shipment; indirect routing; and entry at obscure points.

Frozen and canned shrimp found decomposed also received attention. More than 90 percent of the entire production of canned shrimp is under Federal inspection as will be explained in a later section. Twenty-one official samples from shipments made by uninspected canneries revealed only four lots requiring action because of decomposition. Seizure was made and criminal prosecution recommended. It is a common practice among large dealers in fresh shrimp to send their surplus to a freezer for freezing into 10-pound blocks and subsequent cold storage if the market for fresh shrimp is too sluggish. Too often such freezing is delayed until the fresh shrimp are already partly decomposed. Surveys of stocks of such frozen products resulted in five seizures aggregating nearly 15,000 pounds.

Attention was given, particularly by the Minneapolis station, to a small industry on the shores of Lake Michigan engaged in the production of fish roe. This material eventually finds its way into the manufacture of "whitefish caviar." It was found that the majority of the whitefish-roe packers, of whom approximately 30 were operating, employed extremely primitive methods in preparing their product for shipment to the caviar manufacturers. The result was that the roe was contaminated with portions of viscera and visceral contents and with large numbers of intestinal parasites resulting in a distinctly filthy product. Twenty-six consignments of this contaminated fish roe, or of caviar made from it, were seized. It is entirely practicable to produce a clean and acceptable product by the employment of those elementary sanitary methods that should characterize the production of any food. When the fall packing season begins, supervision will again be given this industry to determine whether it has adopted these self-evident precautions.

A new project that would have been instituted earlier had satisfactory analytical methods been available, was launched. A survey of the confectionery industry was undertaken for the purpose of regulating the practices of a minority of the manufacturers who engage in reworking and redistributing unfit returned stocks. Objectionable candy subject to the law may be found in any one of three categories: (1) Material that was sound when shipped, but through improper storage became contaminated in the consignee's possession; (2) such contaminated material returned for credit to the original manufacturer presumably to be destroyed but sometimes remanufactured by the latter; and (3) candy remanufactured from such unfit material and shipped interstate.

Factory inspections promptly demonstrated that sanitary conditions in some establishments were deplorable, that storage rooms were infested with rodents and insects, that raw materials were carelessly stored and subject to filth contamination, and that extremely objectionable returned material was being reworked by some firms into cheap penny goods for resale. Finished products manufactured under such conditions were actually found in some cases to be contaminated with rodent hairs and excreta, insect parts, and nondescript foreign matter. Insanitary conditions, either of storage or manufacture, when noted, were reported to local or State officials and in a number of cases the city or State authorities destroyed accumulated stocks of dirty returned goods and placed an embargo on factory operations until a satisfactory clean-up had occurred. In general, the plants engaged in this type of business are small, although in the aggregate their volume of business is large. Seventy-eight small consignments of filthy candy were seized, representing the output of 38 manufacturers. Criminal prosecution has already been recommended in the case of five firms that were responsible for manufacturing and shipping filthy candy and prosecution actions are in preparation against other shippers. Obviously those manufacturers whose products were contaminated through improper storage by the consignees are not subject to criminal prosecution. Three hundred and seventy-nine manufacturers were given attention. As contrasted with the condition in the plants described above, the majority were scrupulously clean and no evidence of contamination could be found. The manufacture of candy from returned material of this kind and under the conditions observed in some plants is absolutely indefensible. The campaign will be continued until interstate traffic in this type of filthy confectionery is stopped.

Early in the fiscal year an effective method was devised for the detection of insects and insect parts in flour. In the late summer, stations undertook a campaign of sample collection of white flour and similar cereal products on a selective basis, bearing in mind the length of storage, the insect population of the place of storage, and the climatic conditions conducive to insect development. Three hundred and ninety-five samples, representing the output of 197 manufacturers, were examined and 38 seizures resulted. Since insect contamination ordinarily develops after the flour has been shipped from the mill, criminal prosecution of the shippers was not recommended. The flour industry has taken this campaign seriously, and is promoting studies with the cooperation of the Bureau of Entomology and Plant Quarantine designed to prevent the initial infestation of flour, devising more satisfactory storage methods, discouraging the use of improperly cleansed second-hand bags for the packing of flour, and making smaller shipments, particularly in warm weather, so that stocks will move more rapidly.

Importations of cocoa beans exceeded 600 million pounds. Examination was made of 938 lots representing 177 million pounds, or nearly 30 percent of the amount entered. Thirty-nine lots, aggregating 1,376,000 pounds, were

detained because of moldiness or other unfit conditions. This contrasts with detentions in 1937 when examinations were made of more than 281 million pounds with rejections of more than 8,750,000 pounds.

Forty-three shipments of wormy or moldy nuts were seized. Prosecution was instituted in the case of the 5 shippers responsible for 21 of these lots which were unfit at the time of interstate shipment. In addition 11 seizures were made of shelled peanuts consigned to peanut-butter manufacturers and contaminated with dirt and soil. There is a growing realization on the part of the peanut industry that this class of peanuts should not be sold for food use. Importations of nuts examined amounted to 1,125 lots and totaled more than 35 million pounds. One hundred and sixteen lots, totaling 1,680,000 pounds, were detained because of moldy or wormy conditions. This is to be compared with 1,169 lots, totaling 25,864,000 pounds, inspected last year, of which 100 lots, aggregating 625,000 pounds, were denied entry.

The usual inspection of imported condimental seeds was continued. Annual importations amounted to a little over 114 million pounds. Two thousand two hundred and eighty-eight lots, totaling more than 37 million pounds, were inspected; 280 lots, totaling 3,700,000 pounds, were detained, principally because of the presence of insect and rodent excreta or, in the case of nutmegs, mold and wormy condition. This represents a slight improvement over the condition observed last year.

Potatoes in some sections of the northern States were badly affected during the past season with a virus disease known as net necrosis. This condition darkens the edible portion of the tuber and in severe cases makes it unfit for food purposes. External examination of the potato does not reveal the condition and the consumer ordinarily purchases the product unwittingly and loses all potatoes that are affected. Careful potato growers eliminate the portion of the crop shown by sampling to be excessively infected. A brief seizure campaign was conducted with the cooperation of inspectors of the Bureau of Agricultural Economics, resulting in 17 seizures on a charge of misbranding as to grade since the lots contained a larger percentage of potatoes affected with net necrosis than is permitted under the grade designation given on the labels. In six additional instances the amount of diseased potatoes was so excessive that a charge of adulteration because of decomposition was made, resulting in seizure and destruction.

Twelve shipments of frozen eggs alleged to be in part decomposed were seized and criminal prosecution was entered in the case of four shippers of such articles. One seizure of decomposed yolks and one of decomposed albumen were also made, and three of decomposed shell eggs. Prosecution was entered against one shipper for the interstate shipment of incubator rejects. Of the many small firms engaged in the hatchery business, a comparatively small number attempt to distribute incubator rejects for food use. The traffic is difficult to control, however, because of its essentially bootleg nature. Surveillance was maintained with the cooperation of city and State officials and several lots of incubator rejects were confiscated under local laws.

Three hundred and nine lots of imported dates, totaling 31,600,000 pounds, were inspected, with rejection of 94 lots, totaling nearly 6 million pounds, or 19 percent. Rejections greatly exceeded those of last year, when more than 62 million pounds were examined with rejection of only 2,226,000 pounds or about 3.6 percent. Importers ascribed the poor condition of arrivals to delays in shipment, resulting in insect infestation while lots were being held at foreign ports. Three hundred and fifty-one lots of imported figs, totaling 5,913,000 pounds, were inspected, and 57 lots, totaling 629,000 pounds, were rejected. This shows a slightly higher rate of rejection than last year when 6,442,000 pounds were inspected and 608,000 pounds rejected.

A severe freeze in Florida in December 1937 resulted in serious damage to the citrus crop. An extremely effective control system was immediately inaugurated by the State authorities so that the Administration's problem was restricted to an occasional follow-up of small lots where attempts to move truck shipments out of the State were reported by State officers. One small lot of frost-damaged oranges and one of grapefruit were seized. In the latter instance the shipper had obtained a State inspection certificate covering 62 crates of sound fruit. Between the time of inspection and of shipment the certificate was altered to cover the 400 cases of frost-damaged fruit which were shipped and eventually seized. A criminal prosecution was instituted. The shipper pleaded not guilty but was convicted by a Federal jury and was fined $200.

Space limitations preclude further details regarding the attention given other animal, fruit, and vegetable products with a view to apprehending lots adul-

terated through decomposition or insect infestation. It may be stated, however, that among the other commodities proceeded against both by seizure and criminal prosecution, were fresh, dried, frozen, and canned fruits and fruit jams containing insects or mold; fresh spinach heavily infested with aphids; canned peas containing larvae; decomposed rabbits and turkeys; decomposed barreled sauerkraut; and a specialty product consisting of a canned mixture of celery and tomato juice, also decomposed.

FOOD VIOLATIONS INVOLVING ECONOMIC CHEATS

Drug projects and those food projects that involve public health and hygienic violations occupy first place in the regulatory program. Less attention can be given to offenses in the food field constituting consumer cheats. Nevertheless in the aggregate a large amount of attention is given annually to such offenses. Short weighting, adulteration with water, debasement with harmless but cheaper fillers, and coloring to conceal inferiority exemplify this type of economic cheat.

The last annual report recorded 61 seizures of butter on charges of short weight, deficiency in butterfat, or both, and stated that 29 criminal prosecutions on this ground had been instituted. The prediction was made that more attention would be given to this form of cheat in the following fiscal year. During the year just closed, 111 seizures of butter, the output of 76 creameries, were made. Criminal prosecution has already been instituted in the case of 30 shippers.

Activities on substandard jams and preserves were sharply curtailed as compared with operations in previous years. This was due to several adverse decisions in contested cases, necessitating a careful review of existing methods of regulatory procedure. Seven seizures of preserves alleged to be substandard were instituted and prosecution was recommended in the case of five shipments. This is to be compared with 24 seizures and 14 prosecutions in 1937.

Alimentary paste, including macaroni, spaghetti, and noodles, annually requires a certain amount of attention because of short weight, the use of inferior flours instead of high-grade semolina, and the employment of artificial color to simulate the use of eggs in noodles or semolina in macaroni. Eighteen seizures were accomplished and prosecution was initiated in the case of nine shipments.

A form of violation of lesser economic importance but interesting as illustrating the variety of products which must be considered, is the adulteration of horseradish. Widespread trade complaint occurred, particularly in the New York market, that extensive adulteration of this condiment was being practiced. It was necessary to develop chemical and microchemical methods for the detection of the cheat. These confirmed the report that cheap roots such as parsnips and turnips were being substituted in part for ground horseradish, the product being artificially flavored, usually with synthetic mustard oil. Three seizures were instituted and a limited campaign on this form of adulteration is still in progress.

McNARY-MAPES AMENDMENT

One hundred and fifty-three seizures were directed against canned foods which failed to meet the standards of quality, condition, or fill of container established under the McNary-Mapes amendment to the Food and Drugs Act and were not labeled to show their substandard character. The summary of seizures given in table 4 shows the increased activity under this amendment in 1938 as compared with 1937.

TABLE 4.—*Seizures of canned goods in 1937 and 1938*

Canned goods	1937	1938	Canned goods	1937	1938
	Number	*Number*		*Number*	*Number*
Cherries	12	47	Mixed apricots and peaches	1	1
Peaches	4	4	Peas	33	57
Pears	2	1	Tomatoes	11	39
Apricots	0	4	Total	63	153

The most common cause of action in the case of cherries was the presence of pits in excess of the reduced tolerance which became effective in July 1937. Overmaturity led most often to seizure in the case of canned peas, while poor

color due to an excessive amount of green fruit was the usual reason for action against canned tomatoes.

SEA-FOOD AMENDMENT

The inspection service authorized by the sea-food amendment was provided to 51 shrimp canneries, an increase of 1 over the 1937 figure. A heavy shrimp catch resulted in a pack totaling 1,181,423 cases, an increase of more than 200,000 cases over that of last year. The pack of inspected shrimp represents approximately 90 percent of the total shrimp pack of the United States.

An appropriation of $40,000 was again made to defray part of the cost of inspection. In addition the packers paid fees totaling $70,595.50. The cost of inspection was a trifle less than one-fifth of a cent for each can of shrimp.

ACTIONS ON DRUGS

The year was marked by two major tragedies attributable to the drug products known as "Elixir Sulfanilamide" and "Rex 152."

In response to Senate Resolution 194 of November 16, 1937, the Secretary of Agriculture on November 25, 1937, submitted a complete report to the Senate on "Elixir Sulfanilamide," which was published as Senate Document 124 and is available on request. This discussion therefore will confine itself to a brief outline of the occurrence with the inclusion of data not available when the Secretary's report was submitted.

Sulfanilamide is a valuable drug that has shown dramatic curative effects. Normally it is administered in tablet or powder form. In response to a demand for a liquid preparation of sulfanilamide, one manufacturer prepared and marketed a product called "Elixir Sulfanilamide" containing approximately 40 grains of the drug per fluid ounce of liquid. The solvent used was diethylene glycol. It was used without adequate tests as to its toxicity in the dosage prescribed, despite previously published reports that it might be dangerous when taken internally.

The manufacturer's headquarters were at Bristol, Tenn., with a branch manufacturing plant in Kansas City, Mo., and distributing houses in New York and San Francisco. Two hundred and forty gallons, or 1,920 pints, of the "elixir" were manufactured; distribution began on September 4, 1937, and continued until October 15, 1937. First reports of death, later demonstrated as caused by this product, reached the Food and Drug Administration on October 14 and an investigation was immediately begun that eventually involved practically the entire field force in the areas in which distributions had been made. From the most conclusive data now available it appears that approximately 107 deaths occurred during September and October as a result of the consumption of this product. The total amount accounted for in the drive made by the Administration and cooperating agencies to locate and remove this highly dangerous article from the market was 1,905 pints, 9 fluid ounces. This amount includes that acquired by seizure, that definitely known to have been destroyed, that collected in the form of samples or dispensed over the counter and consumed. Actually the Administration's agents were able to account for 99.2 percent of the entire amount of the "elixir" manufactured. Considering that four batches were made, that the ingredients were measured in commercial quantities, that there was breakage and spillage during manufacture and packing, it is reasonable to suppose that the 14 pints, 7 fluid ounces unaccounted for represent material lost during the process of manufacture and packing and not goods actually distributed to consumers. The data show that 93 pints, 6 fluid ounces actually reached consumers. Of this about one-half was consumed and caused approximately 107 deaths. The other half was retrieved from consumers and destroyed or collected as samples. Twenty-five seizures of the "elixir" were effected under the Food and Drugs Act, while many lots were seized or embargoed by local officials through actions under State or city laws. Criminal prosecution against the manufacturer has been instituted.

In compliance with the Senate Resolution, the Department's report on the "Elixir Sulfanilamide" episode was accompanied by recommendations for corrective legislation. The Food, Drug, and Cosmetic Act of June 25, 1938, contains comprehensive provisions for the control of all new drugs.

Twelve fatalities from tetanus occurred in Florida during late March and early April 1938, a result of the administration of an alleged cancer serum. First reports of fatalities were received on March 30. At that time the physician attending the first victims attributed their deaths to a product of Canadian origin, also offered as a purported cancer serum. There was some question

as to the extent to which a product of this type is subject to the terms of the Food and Drugs Act in view of the specific provisions of the Biologic Products Act of July 1, 1902. Believing, however, that the seriousness of the situation and the importance of preventing further fatalities warranted action by any governmental organization having appropriate facilities, this Administration immediately began an investigation in which it had the cooperation of the Public Health Service and authorities of Canada and Florida. Between March 30 and April 1, with the cooperation of the Canadian authorities, all consignments of the Canadian product within the limits of the United States were followed up and embargoed. Only six small lots in addition to that furnished to the Florida physician had been sent to this country and no fatalities had occurred at other points. Samples of the Canadian product were administered to animals in the Administration's laboratories without adverse results. On April 1, the attending physician recalled that the fatal medicine was not of Canadian origin but was a similar preparation produced in Philadelphia, which he was also using. It was not a commercial article. It was prepared by a research laboratory and supplied without charge exclusively to physicians. Upon receipt of accurate information as to the source of the product actually responsible for the Florida fatalities, a renewed search for the material was undertaken. All the evidence pointed to the fact that the only poisonous consignments of the medicine bore the control number 152. The records of the producing laboratory showed that the product under this control number had been supplied in small quantities to only eight physicians. These doctors were immediately advised of the probable danger involved in the administration of the product. Similar communications were sent to them by the producing organization which recommended the administration of tetanus antitoxin to any of their patients who received this medication. By April 2 all lots bearing the suspicious control number were under detention. In the course of this investigation official samples were collected from 23 shipments of the poisonous product. One hundred and eleven 10-cc ampuls were examined in the Administration's bacteriological laboratory. Forty-one of these ampuls bore the control number 152 and, of these, 18 contained tetanus toxin. Of the 18 ampuls which contained tetanus toxin, 4 were obtained from the producing organization itself and 14 from interstate shipments. All evidence points conclusively to the fact that the poisonous character of the product was due to faulty laboratory technique in its manufacture.

In last year's report under the caption "Comments on Court Cases" reference was made to a district court decision holding that gauze bandages are within the scope of the Food and Drugs Act. This decision, later upheld by an appellate court ruling, justified the conclusion that the act covers certain prophylactic products not heretofore regarded as drugs. Since a national campaign for the control of venereal disease was then in progress, the Administration on October 4, 1937, issued a notice to manufacturers and dealers in venereal-disease preventives. It announced that regardless of the nature of the products, or methods in which they are used, all articles intended as venereal-disease preventives are subject to the provisions of the act: that it is the consensus of present-day medical opinion that no article that depends upon its chemical action for its preventive properties is sufficiently effective against all venereal diseases to justify an unqualified claim for the prevention of such disease; and that articles depending for their prophylactic effect on preventing contact with infecting organisms should be free from defects. An extensive survey of rubber and membrane prophylactics was then instituted. One hundred and eighty-one consignments of these products labeled as useful in the prevention of disease were seized when examination showed them to be defective. They represented the output of nine manufacturers. As a result of these actions very extensive withdrawals of outstanding stocks were made by producers, with drastic changes in manufacturing processes.

False and fraudulent therapeutic claims on medicines intended for human use accounted for the institution of criminal prosecutions against 45 defendants and for 117 seizures of the products of 86 shippers. One thousand three hundred and seventeen samples of such products from 692 manufacturers were collected and subjected to chemical analysis or a critical review of the therapeutic claims borne by the labeling. Veterinary remedies similarly misbranded gave rise to 11 seizures involving the products of 10 shippers and to prosecutions against 15 manufacturers. A total of 226 samples of veterinary medicines was collected and 123 manufacturers of such products were given attention.

Chemicals and preparations purporting to comply with the standards of the United States Pharmacopoeia gave rise to 43 seizures and the institution of

criminal prosecutions against 13 manufacturers. Exclusive of ether, the total number of samples of chemicals and chemical preparations, purporting to be of pharmacopoeial quality, analyzed amounted to 2,072, the products of more than 450 manufacturers.

Two hundred and forty-one shipments of ether were sampled and 2,916 individual cans were chemically tested. The contents of 111, or 3.8 percent, failed to meet the pharmacopoeial standard. As a result 11 shipments were seized. In 1937, out of 2,689 individual containers of ether tested, 219, or 8.1 percent, failed to meet the pharmacopoeial requirements.

Substandard glandular preparations claiming to comply with requirements of the United States Pharmacopoeia resulted in one seizure and criminal action against one manufacturer.

Chemicals and chemical preparations purporting to be of National Formulary quality accounted for criminal actions against seven manufacturers. Glandular preparations failing to meet the National Formulary requirements resulted in two seizures. Totals of 1,564 samples of National Formulary chemicals and preparations and 25 National Formulary glandular products, representing some 300 producers, were examined.

Unofficial chemicals and preparations, including unofficial glandular products, to the number of 2,757, the output of approximately 500 producers, were examined. As a result seven seizures of unofficial chemicals and preparations, involving five shippers, were made and criminal prosecutions were instituted against nine manufacturers. Six unofficial glandular preparations, the output of three producers, were seized and criminal prosecutions instituted against three manufacturers. Additional actions in the drug field included 16 seizures of nonsterile absorbent cotton and cotton swabs, 20 of other nonsterile dressings, and 1 of nonsterile catgut sutures, the total representing the output of 21 manufacturers; and a criminal prosecution in the case of a highly dangerous dinitrocresol reducing agent bearing false and fraudulent therapeutic claims. In the last instance a plea of nolo contendere was entered and the court imposed a fine of $50.

A novel feature of the regulatory activities was the uncovering of an extensive practice of adulteration of sandalwood oil. The adulteration had obviously been cleverly performed under chemical control with a view to producing an article that would meet the pharmacopoeial tests. As a result of this discovery, 24 shipments were seized and a criminal prosecution is in course of preparation.

Additional regulatory actions on products in the drug category will be described in later sections of this report.

BACTERIOLOGICAL STUDIES OF FOODS AND DRUGS

Bacteriological investigations including those on food poisoning already referred to, as well as other studies relating to Food and Drugs Act enforcement, required the examination of 1,167 domestic and import samples, comprising a total of 18,074 subsamples. There are included in this category many products, particularly of marine origin, in which organoleptic examination alone was made for the purpose of determining possible decomposition. Work reported under this heading does not include field examinations made in connection with the crab-meat survey and sea-food inspection project.

As an illustration of the material examined it may be stated that 74 samples of catgut sutures, the output of 11 manufacturers, were tested bacteriologically. The product of one manufacturer was found contaminated and seizure was effected as already reported. Approximately 98 percent of the 1,183 individual sutures examined were sterile. Forty-seven samples of absorbent cotton and cotton swabs and 63 of bandage, surgical gauze, and similar materials, totaling 1,519 individual packages, were tested. The regulatory actions taken have been reported in the preceding section.

Continuing attention has been given to the bacteriological condition of medicinal solutions in ampuls. One hundred and eighty samples, totaling 1,031 ampuls, were examined for sterility. In this series there were represented approximately 80 different products ranging from distilled water and physiological salt solution to complex glandular preparations, including several samples of serums used as blood coagulants. The ampuls were collected from shipments by 44 domestic and 10 foreign manufacturers. Five lots of phenobarbital sodium in crystal form intended for injection without prior sterilization, all prepared by one producer and examined early in the fiscal year, were found unsterile. Seizure was effected. Samples of this substance from shipments by the same manufacturer later in the year were consistently sterile, showing that the fault in preparation apparently had been corrected by the producer.

VITAMIN TESTS

Examination of importations reflects a notable improvement in the vitamin D content of cod-liver oil offered for animal feeding. Last year it was reported that 283,111 gallons, or 32.1 percent of the volume of the oil examined, were refused entry for failure to meet the minimum legal standard of 85 U. S. P. units of vitamin D per gram. Examination of shipments, representing 919,526 gallons of oil, resulted in the refusal of entry of 40,873 gallons, or 4.4 percent of the volume of oil examined, for failure to meet the standard for vitamin D. In addition there were 7,950 gallons of oil for which claims were made for vitamin D in excess of 85 U. S. P. units that were found to be below the declared potency. The assay, by the Association of Official Agricultural Chemists method, involving the use of baby chicks, of interstate shipments of cod-liver oil and other vitamin D-carrying oils for poultry, was begun near the close of the year. This program necessitated acquiring additional personnel, installing equipment, and obtaining through experimentation certain basic information relating to the limitations of the method.

A number of reports have been received implying that cod-liver oil of foreign origin is being adulterated with other fish and fish-liver oils. The definition for cod-liver oil in the United States Pharmacopoeia is very broad, permitting the use of oil from the livers from any species of the family Gadidae. Forty or possibly even more species of cod are included in this group. Even though cod-liver oil, U. S. P., must meet certain specified tests for identity and purity, these tests are insufficient to guarantee an oil from one or more of the species enumerated, and there is insufficient information concerning the physical and chemical properties of various fish oils to detect many types of adulteration. Some degree of remedy would seem to lie in the official recognition of vitamin A- and D-containing oils other than cod-liver oil as suitable sources of these vitamins.

A total of 112 biological assays has been made on 93 samples from interstate shipments of various types of vitamin preparations. Twenty-eight of these samples were found to be deficient in one or more of the vitamins claimed to be present. Five seizures and one criminal prosecution involving vitamin preparations were instituted and other actions are in course of development.

Chemical examination for vitamin C and spectrophotometric examination for vitamin A have proven very useful. An organic chemist has been assigned to study chemical methods that have been proposed for the determination of various vitamins so that full use may be made of developments that may simplify the control of vitamin-containing products. A method for the determination of vitamin B_1 which is well adapted to enforcement work has been developed. It is a modification of a procedure involving the cure of polyneuritis in rats, which was proposed several years ago and which has been used extensively by manufacturers of vitamin B_1 products.

PHARMACOLOGICAL INVESTIGATIONS

Routine biological assays were made of 468 drugs and drug preparations as noted in table 5.

TABLE 5.—*Biological assays of imported crude drugs and imported and domestic drug preparations, fiscal year 1938*

Article	Samples examined	Samples requiring detention	Article	Samples examined	Samples in violation
Imported crude drugs:	*Number*	*Number*	Domestic drug preparations:	*Number*	*Number*
Aconite	9	0	Digitalis	96	3
Digitalis	19	14	Epinephrine	55	3
Ergot	52	5	Ergot (crude)	1	0
Strophanthus	6	0	Insulin (specialties)	6	6
			Posterior pituitary	65	3
Total	86	19	Squill	15	0
			Strophanthus	14	0
Imported drug preparations:			Estrogenic	35	14
Digitalis	6	0	Corpus luteum	4	2
Epinephrine	6	0	Miscellaneous, unofficial glandular	3	0
Pituitary (posterior)	7	3			
Estrogenic preparations	56	20	Total	294	31
Corpus luteum	8	8			
Miscellaneous, unofficial glandular	5	0			
Total	88	31			

Of the 14 importations of crude digitalis detained, 12 were objectionable because of high moisture and acid-insoluble ash and 2 were spurious drugs. Four of the detentions of crude ergot were made because the products were not packed in airtight, moisture-proof containers as required by the United States Pharmacopoeia; the fifth was occasioned by excess moisture. Detentions of posterior pituitary preparations were based on unwarranted therapeutic claims rather than on lack of potency.

Of 102 digitalis preparations examined, 28 were pharmacopoeial and 74 were specialties such as capsules, fluidextracts, pills, pulvules, pulvoids, tablets, and ampuls. In only three instances involving specialties was a variation from the declared potency discovered warranting citation under the act. The regulatory actions initiated in connection with domestic glandular products have already been described in the drug section of this report.

Research work, conducted in the Division of Pharmacology, closely connected with regulatory operations included studies of methods of assay or analysis for pituitary, digitalis, thyroid, theelol, parathyroid, methyl bromide, and ergot; studies of acute toxicity of sulfanilamide (ortho, meta, and para), diethylene glycol, diethylene-glycol-mono-ethyl-ether, ethylene glycol, propylene glycol, and similar solvents, and studies of chronic toxicity of these solvents and various coal-tar colors.

DEVELOPMENT OF NEW ANALYTICAL METHODS

The laboratories of the Administration, particularly its technical staff units in Washington, are continually engaged in the development of new analytical methods or the improvement of old procedures as a means of demonstrating more effectively the presence of adulterants in food and drug products. Not infrequently these must be worked out under emergency conditions as was the case when the "Elixir Sulfanilamide" tragedy occurred. As a result of that incident, methods were promptly developed for the estimation and identification of diethylene glycol and subsequently this work was extended and procedures were worked out for the isolation of other glycol solvents such as ethylene glycol, propylene glycol, and commercial diethylene-glycol-mono-ethyl-ether.

Work has been continued on methods for the accurate and speedy estimation of lead in foods and biological materials, particularly with a view to removing substances that interfere with the isolation and determination of this metal. Tin, iron, and about 85 percent of the bismuth have been successfully removed with cupferron which forms ether-soluble compounds with these metals. Subsequent colorimetric determination of lead requires some modification because of the oxidative effect of this reagent on dithizone. Interfering amounts of tin and bismuth are now readily detectable by the use of two auxiliary color filters in the improved neutral wedge photometer discussed in earlier reports. The successful stabilization of dithizone has been accomplished by the substitution of carbon tetrachloride for chloroform as a solvent. Overlaid with sulphur dioxide solution the reagent undergoes no measurable change in spectral properties over long periods. Not only does this improvement show promise of permitting the codetermination of lead, tin, and bismuth with multiple color filters, but it will also permit much greater precision in determining lead in biological samples like blood, spinal fluid, and hair, where the amount available for analysis is necessarily small. The occasional inclusion of lime-sulphur in the washing solution for the removal of spray residue from apples gives an apparent lead content considerably below the true one when the apples are analyzed soon after washing. By the substitution of nitric for hydrochloric acid in the rapid stripping method this analytical error has been corrected and true results can be obtained.

Extensive collarobative work on determining small amounts of flourine in food phosphates has led to fundamental studies on the influence of distillation equipment on results and these in turn have necessitated studies on the role of quantity of indicator, hydrogen-ion concentration, and salt effect in the titration of the neutralized distillate with thorium nitrate. The resultant modified titration method is sensitive to less than 1 microgram (0.001 mg) of flourine.

A newly designed photoelectric photometer promises a sensitivity of the same order in the peroxidized titanium colorimetric method. The desirability of independent methods of determination in developing much needed information on the fluorine content of our food supply is obvious.

A quantitative method for the estimation of boron in water and allied substances, reducing the time required for this determination, was developed.

Methods adequate to establish that decomposition has occurred in animal and vegetable food products are an ever-recurring necessity in food-law-enforcement work. Microanalytical, bacteriological, chemical, and organoleptic methods are all relied on to establish that a food product is adulterated in that it consists in whole or in part of a filthy, decomposed, or putrid animal or vegetable substance. In some classes of food, odors of decomposition are an infallible indication of the unfitness of the product and certain technicians in the Administration's force have developed their sense of smell to such a point that their findings are accepted without question. Nevertheless, more nearly quantitative analytical procedures are always desirable. Encouraging progress has been made on chemical indices of decomposition in various food products and these are still in course of study. As another step in the process of studying decomposition of marine products, investigation is in progress for the purpose of determining the groups of organisms responsible for the spoilage of herring roe, since inspection evidence has suggested that the canned product needs attention. The purpose is to determine the facts with regard to the rate and type of spoilage under observed and usual conditions of handling and to correlate certain criteria such as odor, appearance, and texture of the raw product in various stages of decomposition with those of the canned product prepared from such material. Experimental packs of canned roe have been prepared in commercial establishments and field studies have been conducted on the bacteriological phases of spoilage. The work so far carried on demonstrates that this is a highly perishable product that must be handled carefully and speedily if the canning of unfit material is to be avoided.

The cream and butter project has inspired a great deal of research on the development of analytical procedures for the estimation of decomposition. Studies are being made of the influence of age, temperature, and sanitary conditions on the acidity of cream. An investigation of the influence of the same factors upon the mold content of cream has lead to the development of a quantitative technique for the estimation of mold in cream and in butter made from it. This method has been published. The employment of this procedure by butter producers in testing commercial deliveries of cream would undoubtedly be of material assistance in eliminating unfit cream, since sound cream will show little, if any, mold residues while cream of poor quality will generally show mold. The method for the estimation of mold in butter will furnish a basis for legal action against shipments of butter made from decomposed cream.

Work on alcohol-insoluble solids as an index of maturity in canned peas was continued during the 1938 season. Pods were sorted into four degrees of maturity and experimental packs made of peas containing previously determined proportions of each class. Color photographs, by two different processes, were made of the four classes of peas, and of the pods themselves, as well as of the peas and vines, and were preserved as a permanent record. In no instance have peas, immature by visual observation, shown alcohol-insoluble solids above 23.5 percent in the canned product. The standard of quality and condition for canned peas established under the McNary-Mapes amendment to the Food and Drugs Act contains as one of the criteria of immaturity for canned peas a requirement that the alcohol-insoluble solids of the drained peas shall not exceed 23.5 percent.

COMMENTS ON COURT CASES

Fines assessed by the Federal courts in terminating food and drug cases under the statute ranged from as low as $4 to a maximum actually paid of $3,000. Higher financial penalties were assessed in several cases but were remitted in large part by the courts. Jail sentences were imposed in several instances but were suspended and the defendants placed on probation. In one case, however, involving the substitution of cottonseed oil for olive oil the court assessed a fine of $100 on each of 12 counts and 30 days in jail on each count, the jail sentences to run concurrently. The court stated that he appreciated the widespread character of this type of fraud and was resolved to impose deterrent penalties.

Eleven criminal prosecutions were terminated for shipment in interstate commerce of polluted crab meat. Two of these were contested actions in which verdicts of guilty on one or all counts of the informations were found. In other instances pleas of guilty or nolo contendere were filed by the defendants. Fines were imposed in each instance and the courts took occasion to warn defendants that future violations would be met with far more drastic penalties.

Reference has been made to the loss of several cases by the Government involving alleged adulteration and misbranding of jellies and preserves. They were decided against the Government in Federal courts in El Paso, Phoenix, Chicago, and Brooklyn. The issues primarily responsible for the adverse decisions were lack of definitely established legal standards for the products and the difficulty of demonstrating deficiency of fruit by evidence based on objective chemical analyses. Under the Food, Drug, and Cosmetic Act of June 25, 1938, the difficulty growing out of the lack of Federal standards will presumably be corrected. Steps are being taken by the Administration to devise more effective methods of presenting its analytical findings.

On May 24, 1938, the United States Circuit Court of Appeals for the Fifth Circuit, in a divided opinion decided in favor of the claimant a case involving the use of artificial color in an orange-beverage base. The product bore a label reading, in part, "Orange Juice Sweetened" with a less conspicuous subsidiary label statement reading "Fruit Acid, Certified Color and 1–10 of 1% benzoate of soda added Directions: Use one part with five parts plain water, well iced." The product was prepared from orange juice, sugar, fruit acid, certified color, and benzoate of soda, and contained approximately 50 percent of added sugar and sufficient coal-tar dye to produce a color about five times as intense as the natural color of the article. The Government contended that the artificial reddish-yellow dye made both the beverage base and the beverage made from it according to the directions on the bottle label, appear to contain far more orange juice than was actually present, and that the product was therefore misbranded. The majority opinion stated in part:

> The color of the product is far deeper than that of orange juice, and looking at it one would know that it was not mere orange juice. But when diluted in the customer's presence by the retailer, it becomes of about the color of orange juice and simulates its taste. It is true that the beverage which the retailer thus prepares and sells is inferior to pure orange juice in its vitamin content, and the added color tends to conceal the weakness of the orange juice content, but this beverage is not shipped in interstate commerce, and its preparation and sale is not within the Food and Drugs Act.

The dissenting opinion filed by the presiding judge stated in part:

> Conceding that the product is not deleterious to health, it certainly is not orange juice sweetened in the ordinary meaning of those words. It might as well be called sugar acidulated. The words "Orange Juice Sweetened" are in large type. Other parts of the label fairly describing the ingredients are in very much smaller type. It is not probable that a purchaser of a drink made from the compound would notice the fine print. I consider the label tends to deceive and mislead the ultimate purchaser and therefore the article is misbranded within the prohibition of the Food and Drugs Act.

A rehearing of this case is being sought by the Government.

In a contested action involving adulteration of tomato paste with insect fragments, tried before the court without a jury, the court in finding for the Government stated, among other things:

> There can be no doubt that this section of the act was designed to protect the aesthetic tastes and sensibilities of the consuming public and that the visible presence of such material in food would offend both. Conceding this the claimant argues that the statute is directed only to filth which is perceptible by the consumer. With this I cannot agree. To so interpret this section of the statute would largely deprive the public of the protection it seeks to give. The consumer ordinarily requires no governmental aid to protect him from the use of food products the filthy adulteration of which he can see, taste, or smell. What he really needs is government protection from the food products the filthy contamination of which is concealed within the product. I am quite clear that it is the intent of the statute to bar such products from the channels of interstate commerce.

The first criminal action involving the misuse of the Federal inspection legend authorized under the sea-food amendment was terminated with a plea of guilty in October 1937. A violation of the statute was alleged in that the canned shrimp in question bore the label statement "Production Supervised By U. S. Food and Drug Administration," whereas the product had not been packed under such supervision. On entry of a plea of guilty the court imposed a fine of $1,000, suspended payment, and placed the defendant on probation for 12 months.

Last year's report made reference to a decision in the United States District Court for the Southern District of New York in May 1937 holding that sterilized gauze bandages are a drug within the meaning of the act. The decision was appealed by the manufacturer to the Circuit Court of Appeals for the Second Circuit, which on February 7, 1938, unanimously affirmed the lower court decision.

A criminal prosecution of interest because in the course of trial the court held some of its sessions in the laboratories of the defendant and in those of the Food and Drug Administration involved the interstate shipment of a product

labeled as "Pituitary Extract Obstetrical (10 International Units per cc)" alleged to be adulterated and misbranded in that it possessed a potency twice that declared on its label. The product was tested by the bioassay method described in the United States Pharmacopoeia which depends upon the contracting effect of the article when applied to a strip of animal tissue.

The following quotation from the court's verdict upholding the Government's charges is self-explanatory:

> The accuracy of this procedure was confirmed by a series of joint assays made with my approval of another specimen of defendant's product in the laboratories of the defendant and of the Food and Drug Administration at Washington * * *
> The evidence of both the Government and the defendant in this case * * * shows beyond doubt that the defendant's product here involved was substantially overstrength and far beyond the limits laid down in the Pharmacopoeia. The conclusion is inescapable that the defendant is guilty of violating the Food and Drugs Act.

A fine was imposed upon the defendant and paid.

Six criminal cases growing out of the adulteration of olive oil with tea-seed oil were terminated with pleas of guilty or nolo contendere and the imposition of fines.

INSECTICIDE ACT

The enforcement work under the Insecticide Act presents comparatively few novel features from year to year though insecticides and fungicides are continually being improved and new ones frequently appear on the market. The important insecticides and fungicides require annually the same relative amount of supervision. The reports of activities under this act are therefore necessarily statistical and more or less repetitious. As new products appear on the market, however, they are subjected to careful tests to determine their limitations and conformity with legal requirements.

During the year, 2,527 samples of insecticides, fungicides, and disinfectants involving the output of about 750 manufacturers were examined. In addition, 386 samples were collected from consignments offered for importation.

These are classified as follows:

Domestic:	*Samples*
Arsenate of calcium	93
Arsenate of lead (paste and powdered)	177
Paris green	31
Bordeaux mixture and combinations of bordeaux mixture with arsenicals	122
Lime-sulphur solution and sulphur preparations	237
Lubricating-oil-emulsion sprays	62
Miscellaneous insecticide and fungicide preparations for agricultural use	379
Preparations for the treatment of mange of animals	28
Preparations for lice and fleas on animals (including poultry), and for chicken mites	173
Sprays for house flies and for the protection of animals against flies	119
Preparations for the control of clothes moths	314
Preparations for other household insects	309
Preparations for the control of ants	42
Disinfectants, germicides, and bactericides	298
Sodium hypochlorite disinfectants and related products	75
Miscellaneous and fraudulent preparations	68
Total	2,527
Imports	386
Total	2,913

Ninety of the domestic samples were made the basis of seizure or of criminal prosecution. Twenty-seven shipments representing products of 17 manufacturers were seized, and criminal prosecution was recommended against 41 manufacturers. Twenty-six import shipments found in violation of the act were denied entry or detained pending correction of the label.

AGRICULTURAL INSECTICIDES AND FUNGICIDES

The usual extensive tests of calcium arsenate, lead arsenate, paris green, and commercial bordeaux mixture were made. Of the 376 samples of these products analyzed, prosecutions were developed on the output of two manufacturers. The products involved were powdered lead arsenate and paris green. The lead arsenate was an impure product containing high water-soluble arsenic that causes it to be injurious to foliage when used as directed. The paris green was contaminated with a large amount of calcium arsenite. As a result of past supervision of this field and of standardization by manufacturers, most of these products are satisfactory but continued surveillance is necessary since even a few batches of faulty material may cause very serious injury to the grower.

As stated in the last report, organic insecticides intended to be used in place of arsenicals to avoid difficulties from spray residues, such as derris, cube, and pyrethrum preparations, and those containing synthetic organic compounds, continue to increase in importance. Extensive tests have been made to determine their value. Some of them have been found to be very effective for the purposes intended but many have been found to bear unwarranted efficacy claims and have been removed from the market or required to be relabeled.

There have been placed on the market a number of garden insecticides and fungicides in the form of cylindrical cartridges to be used in a special form of sprayer attached to a garden hose. In most cases these cartridges have been found to dissolve or disintegrate unevenly so that part of the plants might receive a treatment of proper strength but others would receive a spray so concentrated as to injure the plant or so weak as to be of no value. A number of these products have been removed from the market or their label claims have been limited to the actual value of the product under practical conditions of use.

As a result of the difficulties encountered by orchardists in connection with bordeaux mixture, there have been many attempts to replace it with other copper fungicides that will be effective against the diseases controllable by copper compounds without causing injury to vegetation. A number of new fungicides of this type have been placed on the market. These products are now undergoing tests and on the basis of the results already obtained some of them have been found to be misbranded and action has been taken against their manufacturers. Investigations have shown that there is only a very narrow margin of safety between the amount of copper in available or reactive form that must be present to kill the fungous spores and the amount that will cause injury when used on apple foliage. Close watchfulness over these products is therefore necessary.

HOUSEHOLD INSECTICIDES

A larger number of fly sprays has been examined, since the development of chemical methods has made it possible in many cases to determine without actual test whether a product will be effective. In doubtful cases tests against flies are made to determine their value definitely. While a large proportion of the commercial fly sprays on the market are of satisfactory strength, some are of little value, a few having been found that consist merely of kerosene with some added substance to hide the odor. During the year as a result of appropriate action many of these weak or worthless sprays have disappeared from the market.

Moth preparations continue to require attention, since a large number of them are put on the market without sufficient testing by the manufacturer to determine their effectiveness. The methods employed for testing so-called moth-proofing preparations—that is, preparations which leave in the fiber of the article to be protected a residue that will prevent moth attack over considerable periods of time—in the past have not been entirely satisfactory, but they have now been improved so that the effectiveness of these preparations can more readily be determined, thus offering better consumer protection in this field.

The presence on the market of a great number of poison ant baits has necessitated extended investigational work to evaluate their merits. These products are effective only when they contain a sufficiently attractive bait to draw the ants to them and cause them to eat the poison. There are many different species of ants: some infest households; others cause injury to lawns or gardens. Their feeding habits vary and frequently a bait that is attractive to one will not be attractive to another.

INSECTICIDES FOR USE ON ANIMALS

Further work has been done on fly sprays for use on cattle and horses. In addition to repellent claims many of these products have been found bearing claims for killing flies when the animal is sprayed with the product and some are even stated to kill flies which alight on a sprayed animal. A number of these have been found to be ineffective in killing flies by spraying and none was effective in killing flies which alighted on sprayed animals. Of the 50 samples tested, action was taken in 16 cases. Animal fly sprays that have been found to be worthless have been removed from the market.

ANALYTICAL METHODS FOR INSECTICIDES

Additional work has been done on the determination of pyrethrin I in fly sprays and other pyrethrum preparations by the mercury-reduction method, and the method of determining pyrethrin II has been improved. Since a number of substances in commercial products may interfere in this method, however, it is not entirely satisfactory and work on it is being continued. Methods for the determination of rotenone in derris and cube root have been adopted and published, and studies of its determination in other mixtures are in progress. Difficulties in the determination of formaldehyde in certain commercial products containing interfering substances have been overcome and satisfactory methods worked out. There has been a material increase in the use of various complex synthetic organic materials in insecticides and fungicides appearing on the market, some of them being distributed on a large scale. Work on these is being initiated in order that the Administration may be in position to judge the value of products containing them on the basis of chemical analysis.

BACTERIOLOGICAL TESTING METHODS FOR DISINFECTANTS AND ANTISEPTICS

The factors that control the strength of certain bacteria cultures used for test purposes have been investigated. It has been found that variations in the character or amount of beef extract used in the preparation of the culture media are of vital importance in their effect on resistance of the culture. Investigations on the resistance of spores to disinfectants are under way with a view to setting a standard of resistance for spores to be used in bacteriological tests.

CAUSTIC POISON ACT

The Caustic Poison Act safeguards the distribution of 12 dangerous caustic or corrosive acids and alkalies and preparations containing them. Inspection of shipments disclosed quite general compliance with labeling requirements. It was necessary to institute seizure or criminal action in only five cases. Three of these were disinfectants containing more than 5 percent of phenol; one was a tonic and medicine to be administered to turkeys in the drinking water, with a content of more than 10 percent of hydrochloric acid; and one was a preparation for skin eruptions, which contained more than 5 percent of phenol. Most of the infractions brought to light involved minor deviations from the specific statutory requirements, such as failure to employ the exact style and size of letters for the word "poison" and the use of antidotes not regarded as entirely adequate. Citation in most instances resulted in prompt correction.

Notices of judgment issued reporting the termination of criminal prosecutions previously instituted for violations of the act by four hardware dealers in the District of Columbia. These merchants sold hydrochloric acid (muriatic acid) in discarded pint and half-pint whiskey and gin bottles bearing the original beverage labels, without applying the warning or informative markings required by law to show that the contents of each bottle were in fact a deadly poison. Caustic and other dangerous materials are frequently retailed in old beverage containers and serious risks are involved unless the old labels are removed and appropriate warning labels affixed. Control over sales of this type under the Federal statute is limited to transactions in the District of Columbia and the Territories of the United States, and to shipments of the article across a State line. Some States and cities—but by no means all—have comparable laws governing retail sales.

Investigation having disclosed that phenol and other of the caustic or corrosive substances covered by the act are used in the manufacture of indelible and other marking inks, a trade notice was issued calling manufacturers' attention to the labeling requirements of the act.

IMPORT MILK ACT

During the year all permit holders entitled to ship market milk or cream into the United States were situated in Canada. The number of permit holders, as well as the volume of importations, was below that of the preceding year. Three shippers were dairymen who furnished milk or cream in small amounts to communities on the border, while six plant operators catered to larger markets consuming pasteurized cream. Importations of Canadian cream amounted to 83,940 gallons, all of which entered during the period from July 1937 to February 1938.

No violations of the act were recorded. Regular inspections of the establishments of shippers, as well as of the herds and premises of their contributing patrons, revealed no direct cause for suspension of permit. One dairyman, however, was located in a community where some cases of typhoid fever were reported and, as a protective measure to guard against the possible introduction of typhoid fever into the United States, the permit of this shipper was suspended temporarily.

TEA ACT

A total of 85,589,539 pounds of tea was examined, of which amount 297,156 pounds were rejected by the tea examiners. These rejections represented 0.347 percent of the total.

Of the tea examined, 63,518,336 pounds was fully fermented tea (black tea), 17,610,006 pounds was unfermented tea (green tea), and 4,324,823 pounds was semifermented tea (Oolong tea). Tea of the mixed or variable type accounted for 136,374 pounds.

FILLED MILK ACT

The field stations have been on the alert for violations of the Filled Milk Act. At present, however, only one manufacturer is producing filled milk for interstate sale. For this reason activity under this act has been confined almost exclusively to the prosecution of litigation against this firm. This litigation finally reached the United States Supreme Court on a question of the constitutionality of the Filled Milk Act. The Court rendered an opinion on April 25, 1938, upholding the constitutionality of the statute, and remanded the case to the original district court for trial on the issues. The case still awaits trial in the district court for the Southern District of Illinois, southern division. Shortly after the decision of the Supreme Court was rendered the manufacturer filed a suit against the Secretary of Agriculture to enjoin the enforcement of the Filled Milk Act against his new product, which contains vitamins. This injunction proceeding is still pending.

NAVAL STORES ACT

REGULATORY WORK

One hundred and nine firms and individuals making interstate shipments of turpentine and competing thinners and two firms dealing in rosin were given attention under the regulatory provisions of the act. A total of 139 interstate samples of turpentine and 1 of rosin was collected, representing 89 distributors. One shipper of misbranded turpentine and one of misgraded rosin were cited. The turpentine case is pending, while the rosin shipper has requested Federal classification and grading of his rosin to avoid further violation. A case against one shipper has been recommended for prosecution. Two criminal actions based on misbranding of turpentine in 1937 resulted in pleas of guilty and were terminated by fines.

The regulations for the enforcement of the Naval Stores Act were entirely revised in the light of experience gained since the passage of the act of 1923.

SERVICE WORK

Sixty-two different rosin producers, so-called operators, located in the southern producing States, submitted requests to have their rosin classified and graded throughout the year by Government graders. This work was done at the stills under a regular schedule for inspection (in most cases bimonthly) and under a schedule of fees as set up by regulation. A total of 136,068 barrels and drums of rosin was classified and graded under 1,224 Federal Rosin Classification and Grade Certificates. Two lots of turpentine, comprising 350 drums, for export shipment. were classified and graded on request of the shipper, and covered by certificates. One hundred and twenty samples of turpentine were examined for the Commodity Credit Corporation, representing monthly samples taken from southern storage tanks in which stocks pledged by producers as security for Government loans were held for account of the Commodity Credit Corporation. Thirty-one samples of rosin were graded for the Panama Canal office.

Thirty-five samples of turpentine were submitted to the Administration's Washington Naval Stores laboratory for analysis and classification: two lots of rosin (154 barrels) were regraded on request at plants of consumers.

Total claims for services rendered and extra expenses incurred under the service feature of the Naval Stores Act amounted to $9,558.29, which was covered into the United States Treasury as miscellaneous receipts.

COLOR-MEASUREMENT WORK

The photoelectric photometer for determining the grade of rosin based on fundamental light-transmission data has been further improved. This instrument facilitates the acquisition of data on the relative weights given to the chromaticity and the brightness of a sample of rosin by different graders, and permits the development of rosin grading along more scientific, rational lines. Several large rosin manufacturers have copied the design of this instrument for their own laboratories.

A quartz spectrograph that incorporates the latest optical data and scientific information has been designed. With this grating, ultraviolet radiation from a hydrogen arc lamp will be used to study the ultraviolet-light transmission properties of naval stores and other products within the scope of work of the Food and Drug Administration.

ROSIN STANDARDS

There are now on loan to naval-stores-producing and consuming industries, and dealers and inspectors, 80 sets of duplicate United States official rosin standards. These standards have proven entirely satisfactory in general grading use. A paper on suggested standards for color grades of turpentine, as recognized in the trade, was published.

CERTIFICATION OF COAL-TAR COLORS

Thirty-two manufacturers submitted samples from 1,366 batches of straight dyes, repacked dyes, and mixtures, for certification. Of these, 18 batches were refused certification, and the remainder were certified as complying with the requirements of the Food and Drugs Act. The quantity of straight dyes certified, not including repacked colors, was 415,596 pounds. Repacked straight dyes amounted to 40,733.5 pounds, and mixtures 278,204 pounds. The total number of pounds of dyes certified falls considerably below that reported for the fiscal year 1937, a decrease which is reflected in all three categories. The number of firms requesting color certification was increased by one over the 1937 figure.

COLLABORATION WITH AND SERVICE FOR OTHER GOVERNMENTAL AGENCIES

At the request of the Federal Trade Commission, 345 reports were prepared and 21 analyses and tests were made, covering 600 products. The reports related principally to the therapeutic value of various drugs, cosmetics, and devices under consideration by the Commission.

In cooperative work with the Post Office Department, reports were prepared in 255 cases and 585 analyses and tests were made of drugs, cosmetics, and devices to serve as a basis for Post Office officials to determine whether or not their distribution was in violation of the postal fraud law.

In addition to the above more than 2,100 samples of foods, drugs, and insecticides submitted by other establishments of the Government were examined, mainly to determine whether or not the products sold to the governmental establishments complied with the purchase specifications. The larger number of samples was submitted by the Veterans' Administration, Federal Surplus Commodities Corporation, Interior Department, Navy Department, Treasury Department, Department of Justice, and Panama Railroad.

Other establishments for which analyses were made included the United States Maritime Commission, Bureau of Standards, State of Virginia, Agricultural Adjustment Administration, Bureaus of Chemistry and Soils, Dairy Industry, and Entomology and Plant Quarantine. Collaboration in the examination of naval stores has been referred to under the section relating to the Naval Stores Act.

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Report of the . . .

CHIEF OF THE FOREST SERVICE

1938

REPORT OF THE CHIEF OF THE FOREST SERVICE

1938

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1938

Report of the Chief of the Forest Service 1938

United States Department of Agriculture,
Forest Service,
Washington, D. C., September 15, 1938.

Hon. Henry A. Wallace,
Secretary of Agriculture.

Dear Mr. Secretary:

In transmitting my annual report, attached, I feel impelled to call attention to the following:

1. We need in forests all the 630 million acres we now have and that are most valuable for forest growth.

2. Yet unless it is abused and neglected, we probably do not and will not need more forest land.

3. For 300 years our forests have been chopped, burned, and depleted. Yet with care and forethought there seems no excuse for a timber famine of national proportions. This may not be true of many regions and localities.

4. We probably need no more forest land, yet in many regions and localities, to increase national income and to help underwrite a permanent and a more prosperous civilization, we do need more and better forests.

5. Public ownership and management are established public policies, yet private ownership holds the key to our forest situation.

6. Many private owners have made progress in forest-fire protection, and some owners are leaving lands in better growing condition. Yet these things do not of themselves assure security and stability to dependent families and communities or to forest industries.

7. Some private owners have also made real progress toward establishing sustained yield, and credit is due them, but the big majority is still geared to quick liquidation.

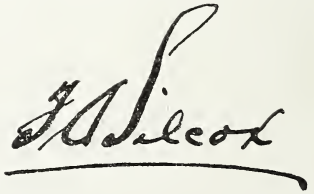
8. Human needs form the keynote of the President's message calling attention to our forest problem and the need for a policy and plan of action with respect to it.

9. In his message the Chief Executive holds that "The public has certain responsibilities and obligations with respect to private forest lands," but that "so also have private owners with respect to the broad public interests in those same lands."

10. Suggesting (*a*) public cooperation (Federal and State) with private owners, (*b*) public regulation of forest lands, (*c*) extension of public ownership and management of forest lands, the President recommends study by a joint committee of the Congress as a basis for action at the next session thereof.

Upon request the Forest Service is assembling data for the Congressional committee and is cooperating with private and public agencies.

Sincerely,



Chief.

Contents

	Page
We need more forests	1
An investment in security	3
Forests and the national income	5
Underwriting a civilization	7
A forest inventory	7
The Columbia River Basin	8
The West coast	8
The Interior	9
The Lakes States	11
The South	12
The President's message	15
A forest policy	16
A plan of action	16
Public cooperation	17
Protection	17
Forest credits	18
Taxation	19
Unity of management	19
Farm forests	20
Research	21
Public regulation	23
Public ownership	25
Community forests	25
State forests	25
Federal forests	26
Public acquisition	27
The Forest Service	28
Action programs	29
The national forests	29
Research	29
Decentralization	29
Personnel management	30
Cooperative relationships	31
Forests, people, and democracy	31
The Civilian Conservation Corps	31
Other work projects	32
Forest folk	32
The national forests	32
An acquisition program	33
Northeastern region	33
Central region	33
Lakes States region	33
Plains region	33
Southern Rocky Mountain region	33
Region of the Columbia River Basin	33
California region	34
The South	34

The national forests—Continued.	Page
Current progress in acquisition	34
Exchange	34
Purchase	34
Donation	35
Transfer	35
Boundary adjustments	35
Abstracting	36
National-forest properties	36
Protecting the national forests	37
Protection from fire	37
Fire prevention	37
Fire suppression	37
The honor roll	38
Protection from insects and diseases	39
Administration and development	39
Land	40
Surveys and maps	40
Highways, roads, trails, and landing fields	40
Settlements, claims, special uses	41
Northern Pacific land-grant suit	41
Water	41
Uses of water	42
Flood control	42
Timber	43
Sustained yield	44
Timber sold and harvested	45
Planting	45
Forage	46
Early administration	46
Distribution survey and policy	47
Market conditions and fees	47
Permits and numbers of stock	47
Reductions, trespass, losses	47
Rodent control	48
Range surveys	48
Local livestock associations	48
Range research	48
Range management	48
Wildlife	49
Basic conditions	49
Basic problems	49
Wildlife management	50
Cooperation	50
Recreation	51
Public campgrounds	51
Facilities for lower-income groups	51
Income from recreation	52
Zoning for beauty	52
Appropriations, expenditures, auditing	52
New legislation	54
Appropriation acts	54
Other acts	54
Administrative statistics	55

We Need More Forests

When Jamestown and the Plymouth colonies were established there were in what is now known as the continental United States some 820 million acres of forest land.

After a young and restless Nation had crossed the Alleghenies and the Appalachians, expanded beyond the Lakes States and into the deep South, scaled Rockies, Cascades, and Sierras: after more than 300 years of pioneering and progress our forest lands now total 630 million acres.

This is half again as large as all our cropland; bigger than all our territory east of the Mississippi River; nearly one-third of the continental United States exclusive of Alaska. As a whole it is more valuable as forest than it is as plow land.

In generations to come a few thousand acres of this land—or a few hundreds of thousands—may be needed for storage reservoirs or some other purpose. But with minor exceptions and unless it is laid waste as a result of abuse or neglect, we can apparently expect that most of this 630 million acres will always be most valuable in forest growth.

Figuring in terms of houses, barns, railroad ties, telephone poles, furniture, boxes, fence posts, firewood—and of plastics, films, lacquers, newspapers, naval stores, dyestuffs, distillates, rayons, and thousands of things having wood as their base—we cannot use 168 million of these acres. This noncommercial forest land is an area larger than Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, New Jersey, Delaware, Maryland, West Virginia, and Ohio. More and better forests are needed on it to help protect watersheds, reduce damage by floods and erosion, clear up muddy streams, restore depleted and impaired water resources, conserve remaining wildlife, afford opportunities for outdoor recreation. But from the standpoint of timber products, this 168 million acres probably always will be noncommercial forest land.

This leaves about 462 million acres. It, too, helps protect watersheds. But as commercial forest land it is the only area we can count on, with care and forethought, as our main source for forest products for domestic consumption and for export.

Even so, it looks as if we had enough forest land; as if as a Nation we now need no more and probably will not need more. Yet on the forest land we have, both now and in the future, we do need more and better forests. We need them because we have drawn on a living

resource without replenishing it; because for more than 3 centuries we have abused a heritage that was once one of the greatest forests in all the world; because we are now paying for that abuse in terms of erosion and floods, in terms of reservoirs, rivers, and harbors choked with silt, and in terms of families, communities, and whole counties left desolate and forlorn.

We need more and better forests because this is a price we can no longer afford to pay. We need them because, of our 462 million acres of commercial forest lands,

(1) About 73 million acres—an area almost as large as all of Virginia, North Carolina, and South Carolina—is now producing so little it is virtually a no man's land.

(2) About 174 million acres—more than Kansas, Oklahoma, Missouri, and Arkansas—are, with few exceptions, not so heavily stocked as they should be and bear trees that are of less than saw-timber sizes, with many diseased, otherwise defective, or weed trees among them.

(3) Only about 215 million acres now bear trees of saw-timber sizes. This area includes our remaining virgin forests. It is larger than all of Montana, Idaho, and Wyoming, but it makes up only about 46 percent of our commercial forest land and only about one-third of all our forest land.

The past has witnessed many estimates of our forest resources. One is known as the Capper Report. Another is called the Copeland Report. Each summarized the forest situation on the basis of the most authentic and most complete data then available. Each drew from these data conclusions honestly and openly arrived at, though, in the opinion of some, both reports overemphasized the imminence of a timber shortage.

The Forest Service is now in the midst of a comprehensive Nation-wide forest survey. This is, briefly, a quantitative and qualitative inventory. It will tell what forests we have and where they are; how, when, and where forest depletion takes place, and how much of it there is; what our requirements for forest products are; how much forest growth we now have, where it is, and how much can be produced under adequate protection and management.

This inventory had not been started when the Capper Report was compiled in 1920. But little data had been gathered when the Copeland Report was assembled in 1933. The present survey is a huge task. When completed, the Nation-wide picture as we have known it may change somewhat. But enough progress has already been made to indicate that on an over-all basis, with reasonable care, the forest lands we now have are capable of producing all the timber we need for domestic consumption plus a comfortable margin for export.

If care and forethought are used there is, it now seems, no excuse for a timber shortage of national proportions. But this is not true of

many broad regions. There are many of them, and many localities; that for years have been face to face with progressive forest depletion, many that already face a shortage with respect to valuable species and grades they once produced in such abundance.

Many of these regions and localities still have forests of a kind; they still produce forest products. But output within them is often insufficient in volume to meet local needs, and in large part it is now confined to less-desirable and less-valuable species and grades. Under these conditions many regions and many localities now use less forest products than they really need, import little because long and costly hauls are involved, and use substitutes.

So, though there is no excuse for a timber shortage of national proportions, there is need for more and better forests.

More and better forests are needed for New England, whose tall masts of clear white pine once helped a tiny American fleet defy the Mistress of the Seas; for the Lakes States, formerly a great forest reservoir, and for the nearby Middle West, both of them now dependent on hauls so long that transportation often doubles the price of sorely needed forest products.

For the South, too, more and better forests are needed; a crescent-shaped South that, stretching from Virginia to Texas, has access by ship and rail to foreign and domestic markets; a South that, sorely needing new and more permanent industries, has 60 percent of its area in forest lands most of which are producing 50 percent or less of what they are capable of producing.

For more than 300 years our forests have been chopped, burned, and depleted. Instead of being cropped they have on the whole been exploited and ravished. Now huge sections of our country, endowed with lands still most valuable for forest purposes, must use less desirable species and grades, or substitutes, or must get many vital forest products on a basis of long and costly hauls. So, though the forest lands we have seem sufficient for present and future needs, we need on them more and better forests.

An Investment in Security

On the forest land we have we need more and better forests to help underwrite industries dependent on them: Sawmills, planing mills, remanufacturing plants, furniture and other factories that with forests had in normal times a capital value estimated at 10 billion dollars; to help underwrite a gross production that averaged close to 2 billion dollars each year, a production that with forests themselves provided pay rolls supporting some 6 million people and making homes, churches, and schools possible for them.

We need more and better forests because, bound up with uses of land for farm purposes, they are part and parcel of a unified agriculture. We need them, too, in areas like the Ozarks and the Cumberlands, for people in regions within which part-time and often precarious farming cannot support thousands of families and hundreds of communities once dependent on original forests, in areas in which there is now too little opportunity for other than forest work.

Like parasites on the past, we draw continuously on coal and iron and oil. We have immense reservoirs of them, but these reservoirs are nonrefillable. Through photosynthesis forests transform solar energy into wealth in the form of a tremendously wide range of physical and chemical products. Forests are the cheapest known source of cellulose, from which there is now made a truly enormous number of things that, like paper, plastics, cellophane, and rayon, are essential to modern living. And forests are refillable reservoirs. Through proper use they increase the wealth of the Nation.

Consumption of forest products often bears little relation to real need for them. This is true of wood used for construction and upkeep of residences and farm buildings, by railroads, industries, and the like. It is also true of the thousands of things, little and big, made from cellulose and lignin. Use of forest products depends on many and variable factors. Scarcity and poor quality of forests in regions of heavy population where wood products are needed, and prices based in large part on long and costly hauls rather than on short and inexpensive ones, are examples in point.

We often need forest products irrespective of such factors. It is reasonable to assume that the greater the supply of timber in regions where forest products are needed most, the greater the use of those products there will be. For they are available, then, to the rank and file—to salaried people and wage earners, who have the bulk of the buying power. The social benefits of forests—their employment of labor for planting, protecting, improving, harvesting, and processing operations—are greater when forests are relatively near large centers of population.

In themselves these things indicate the need for more and better forests.

Use in the United States is not, however, the only measure of our opportunities for utilizing wood in its existing and potential forms. There are many countries that depend on importations of forest products for a large part of their requirements. The United Kingdom is an outstanding example. Our exports, world-wide, include not only lumber but such things as veneer, plywood, and doors. Logs and timbers are also exported.

Moreover, products of the pulp and paper industry are perhaps the most significant forest products in world trade today. And it is well to remember, in this connection, that, except for the Union of Soviet

Socialist Republics, the only big reserves of soft pulpable woods now left are in the southeastern United States, including Oklahoma and Texas, and in a Northwest that includes Oregon, Washington, Alaska, and part of Canada.

In view of such things as these it is a bold man indeed who at this time would attempt to say in what form wood may be used, that the world will not use more wood than it does now, or that investments in more and better forests will not pay. Particularly since throughout the world and over a long period of years the tendency has been for the consumption of wood to increase, and since our forests are capable of supplying the kinds of wood the world demands. A large part of our forest exports are now within the range of quality woods. If we are to keep this business we must continue to grow better forests. And if we grow more, there should be a good chance of exporting more forest products and of maintaining and increasing our purchasing power.

Irrespective, however, of domestic or world-wide demands for forest products and of fluctuations in those demands, we need more forests to help protect huge watersheds and keep dams and reservoirs secure; to help save fine farms and prosperous industrial cities in lowlands from damage by floods and erosion; to provide home and refuge for big game and other wildlife; to furnish opportunities for more people to enjoy healthful recreation and the joys and delights of mountain and forest magic.

We need more and better forests as an investment in national security.

Forests and the National Income

THREE-QUARTERS of all our commercial forest land is in private ownership. Much of it has been abused, but its forests can still be made much more productive. Potentially, therefore, this forest land, which lies within striking distances of rural populations and hundreds of thousands of people who need jobs, is an immense work reservoir.

Private owners have not tackled the jobs of rebuilding and improving their forests and forest lands on anywhere near an adequate scale. Yet with millions of acres idle as well as partly productive, and with the opportunities more and better forests have to serve as employment buffers and increase the wealth of the nation, there is need—with adequate public safeguards—to find some way to accomplish forest rehabilitation on all forest land, irrespective of ownership.

Unless public ownership is considered as an alternative, this raises a question of policy with respect to expenditures of public funds

for rehabilitating forest lands in private ownership. Proposals for expenditures of public funds for forest rehabilitation and development inevitably bring up two other questions: Can we as a Nation afford it? Will it pay? Answers depend in part on the national income, the role forests play in it, and the role they can be expected to play.

Defined as the net value of production, or the money equivalent of goods produced and services rendered, total national income from all sources was approximately 80 billion dollars in 1929. Certain benefits from forests—the extent to which inspiration increases the earning capacity of individuals and communities, for example—cannot be measured in terms of cash. Aside from such intangibles, however, about 3 billion of the 80 billion of national income in 1929 came from wood products of all kinds, plus water conservation and livestock and wildlife production definitely dependent upon forests and forest lands.

Evaluating contributions forests can make after rehabilitation and development are effective is difficult. The evaluation must be based on certain assumptions that will in the course of years be subject to many influences and interpretations. An evaluation cannot therefore be made within narrow limits, but it can point to possibilities and probabilities inherent in forests as a means of helping unemployment and underwriting a permanent and a more prosperous civilization.

Evaluations indicate that the national income from forest lands and forest products can be raised over a period of years from 3 billion dollars to about $5,400,000,000 a year and that this increase in future income may be made possible by a program of forest restoration, rehabilitation and acquisition that might involve a total investment of about 4½ billion dollars plus, ultimately, about $100,000,000 annually for administration, protection, research, upkeep, and overhead.

Restoration, rehabilitation, and (p. 27) acquisition could probably be accomplished, with the investment indicated, within a 20-year period. On a yearly basis the above investment would amount to 225 million dollars.

Is there any question about the Nation's ability to afford an annual investment that approximates only about 11 percent of America's retail purchases at corner drug and cigar stores each year, one that totals less than 3 percent of her annual retail sales of automobiles and accessories, one that, applied to an agricultural population in need of part-time jobs, bids fair to provide constructive work for 200,000 to 300,000 people each year for 20 years—workers who, with dependents, represent 800,000 to 1,200,000 people?

Is there any doubt about an investment that, with the amount needed for protection, management, research, and upkeep, bids fair, after results become fully effective, to provide permanent work for 1,000,000 more people than in normal times have been employed in our forests and forest industries?

Underwriting a Civilization

CIVILIZATIONS the world over are dependent on land and water. If nations are to be permanent these basic resources, and the living ones from which they spring, must be used wisely and well.

The forest is one of these resources. It can be used but renewed; it can contribute to secure, stable, and prosperous civilizations. But forests can also be abused. They can be so badly misused that land itself is laid waste and made nonproductive, that springs go dry and floods ravish lowlands, that social structures decline and families and communities must move on and on as did nomads of old.

In the early Mediterranean civilization forests were abused. History records the decline of that civilization, to which all the world is heir and debtor in much that is worth while in agriculture and the arts. And it has been said that the chief causes of that decline were deforestation and denudation of hillside soil rather than changes of climate or attacks by barbarians.

Our forests have also been abused. Instead of being cropped they have been mined. But nature has on the whole been kind to us. We still have 630 million acres of forest land. This still grows forests of some kind, or forests can be restored on it. On the whole it is and probably always will be more valuable as forest land than for any other purpose. It is, and with care we believe always will be, enough land to serve our forest needs even though 168 million acres of it, vital in such matters as watershed protection and recreation, must from the standpoint of forest products be written off the national ledger.

But although we still have enough forest land, we need on it more and better forests. For they will help provide more jobs and steadier ones, will in this and many other ways help underwrite a permanent and a more prosperous civilization.

A Forest Inventory

THE forest survey indicates that we have more forests than we thought we had, and more forest growth—enough of the latter so that total growth of all species and sizes for the whole country probably comes much closer than we previously thought to total annual drain from all causes.

But the survey also indicates that the annual drain with respect to species and sizes commonly cut and used, in many regions and for the whole country, is still much greater than annual growth. It indicates, too, many localities where forest exploitation takes heavy toll in human exploitation; others where the resource is so depleted that

forest industries—on which communities depend—must be materially curtailed; other regions where the long-haul pattern militates against that demand which forest industries want and need.

Since the forest survey was started in 1930 it has covered in the field more than one-half the total forest area of the United States. Three-fifths of the information has been compiled, analyzed, and interpreted.

The forest survey is not yet completed but enough progress has been made within certain important forest regions or parts of them so that public and private agencies, industries, and individuals can get—as they are getting—authentic and up-to-date data on the basic resource there. It is impossible to go into details here, but high lights of certain forest regions or parts of them, presented in the next few pages, indicate the current forest situation and what can and must be done there if forests are to help as they should to increase the wealth of the Nation.

THE COLUMBIA RIVER BASIN

In Washington, Oregon, Idaho, and Montana, including about three-fifths of all our remaining old-growth timber, forests rank high as an existing and a potential asset. The two main forest regions here are so different that conditions and problems can best be understood if they are treated separately.

The West Coast.—The West coast embraces the heart of what is called the Douglas fir region. It lies in the western half of Oregon and Washington and has close to one-third of all the remaining saw timber in the United States. Field work by the forest survey is completed here. Its figures indicate a total saw-timber stand of 628 billion board feet, one-half of which might be operated at a profit under 1925–29 conditions, two-fifths at an estimated loss of $5 or less per thousand feet, with the remainder still further out of reach commercially.

This region is a work reservoir as well as a forest reservoir. More than 50,000 forest and forest-industry workers are ordinarily employed. On the basis of national averages, their wages support nearly one quarter of a million people.

Five-sixths of the area is forest land, of which 51 percent is privately owned and 49 percent publicly owned or managed. Commercial conifer land totals 25.8 million acres. About 11 million acres are in old growth, producing little if any net increment because natural losses offset growth. About 10 million acres are in growing forests not fully stocked. About 4.4 million acres, once forested and still chiefly valuable as forest lands, are now practically unproductive.

Current annual coniferous growth is computed at 2.7 billion board feet. Annual drain is computed at 9.5 billion board feet. Annual

drain is, therefore, about three and one-half times annual growth. For the region as a whole this might not be so bad, but in the 6 most populous and highly industrialized of the 11 forest survey units the local situation is becoming serious.

Indications are that if cutting practices still generally followed in these units are continued there, old-growth fir will be gone long before new growth is ready for manufacture into lumber of sufficiently high quality to compete successfully with that which can be cut, at that time, in other localities. If the history of the Lakes States and other regions is any criterion, this means most forest industries now operating on old-growth Douglas fir in these six units must quit or, if there is room for them, move elsewhere. Unless something else intervenes this means want and misery for many an already established family and community.

Of the 14.2 million acres of privately owned commercial forest land, about 12.6 million acres are in what might be termed industrial and other (but not farm) ownership. Recent estimates indicate extensive forestry with sustained yield is practiced on about 3 percent of them, and extensive forestry without sustained yield on another 13 to 14 percent. This represents progress. But on nearly 8 million acres of forest lands in industrial and other (not farm) ownership, though they are in more or less productive condition, the owners make little if any effort (other than fire protection) to increase or improve forest capital or to relate mill capacities to the power of the land to produce forest growth. Practically all commercial forest land gets fire protection, but the area in private ownership burned between 1932 and 1936 was four times as much as that set as requisite for successful forestry practice.

The West coast region still has vast stands of old-growth forests. Real progress has been made there in fire protection. By some industrial and other owners, and on part of their lands, real progress has also been made toward sustained yield. Credit is due these owners. Despite competition from a far greater number of less-progressive neighbors, they are now redeeming, in whole or in part, obligations inherent in all forest lands no matter who owns them. But the need for more progress is still acute, for a big majority of private owners are still geared to quick liquidation; the stability—the existence, even—of many communities is still at stake.

The Interior.—The ponderosa pine type borders the Douglas fir region on the east. Forest-survey data in regard to it is now available for eastern Washington and eastern Oregon, to which the following applies.

Total saw-timber volume is estimated at 143 billion feet, board measure; ponderosa pine at 92 billion. About one-third the area is forest land. Of this, 68 percent is public and 32 percent is private property. Ownership is fairly stable. Commercial forest land now

idle because of cutting or fires, or a combination of these and other causes, totals about 534,000 acres.

Of the 13.5 million acres of privately owned commercial forest land, all but 0.7 million acres are in industrial and other (not farm) ownership. Investigations indicate that sustained yield is not yet practiced on these lands on any extensive basis. Extensive forestry without sustained yield is, however, practiced on almost 9 percent of them. Some 5 million acres of commercial forest lands industrially and otherwise (but not farm) owned, though they now have fire protection and are in more or less productive condition, receive no special efforts from owners to improve forest capital or relate mill capacities to the power of the land to produce forest growth. Practically all privately owned commercial forest land, in farm as well as in industrial and other ownership, now receives fire protection.

Current annual growth of saw timber is calculated by the forest survey at 363 million board feet; annual saw-timber drain at more than 2 billion. In general, ponderosa pine is naturally susceptible of management on a sustained yield cropping basis through selective cutting light enough to assure continuous operations and stability for communities. But selective cuttings as heavy as those now practiced on most privately owned forest lands, and a current annual saw-timber drain that exceeds by about fivefold the current annual saw-timber growth, are warning signals that cannot be ignored.

The situation near Bend, Oreg., is an example in point. This example is chosen because Bend offers a striking illustration of a community that, unwilling to take its forest resource for granted, has studied the situation and initiated courageous and constructive action.

In 1910 Bend was a picturesque frontier town of 536 people. It had nearby attractive ponderosa pine forests and good timber relatively close to main-line railroads. If cropped, this was capable of yielding continuous returns and permanent jobs for all time.

By 1930 Bend had become a hustling, hospitable, modern city of 8,848 people. There were some 12 small sawmills close by. At the city's edge were two huge five-band mills. They had a combined rating of 487 million feet per year on a three-shift basis. This was out of all proportion to the power of the land owned and controlled by these two big mills to grow forest crops for continuous harvesting. So was their 1937 cut of approximately 240 million feet; so much so that, at that rate, forest property owned and controlled by one mill might of itself last 8 years; that owned and controlled by the other, 14 years.

Small sawmills near Bend are also on a cut-out-and-get-out basis. Four-fifths of Bend's population is dependent on local forest industries. So are schools, churches, and private property that, exclusive of sawmills, is valued at some 5¾ million dollars. Security and stability—continued existence perhaps—of all these things are at stake.

There is nonoperating forest property near Bend. Some 38 percent of it may soon be liquidated by a mill placed elsewhere. Timber held by other nonoperating owners is in large part subject to liquidation pressures. It, too, is accessible to sawmills other than the two big ones.

There is also public timber—national-forest timber—nearby. It is not subject to liquidation pressures, is ready for harvesting, is tributary to Bend's two big sawmills, and can be sold. When sold it must be harvested on a sustained-yield basis. Managed thus, with nearby privately owned forests similarly managed, it could go far toward solving the problem. But existing legislation requires that when national-forest timber is sold it shall go to the highest bidder. The purpose is to protect public interests. It is, therefore, possible—and not improbable—that a highest bidder might manufacture this national-forest timber elsewhere.

After an investigation a committee from the Bend, Oreg., Chamber of Commerce reported:

> Unless operations in the timber tributary to the Bend mills are placed on a sustained-yield basis, the future of the community dependent on those mills is uncertain * * * [and this will cause] * * * great suffering and financial loss * * * among all classes of the local population.
>
> Your committee believes that the losses that will be suffered if no sustained-yield program is arranged, and the benefits to be secured for every citizen of Bend by the consummation of a sustained-yield program are such as to call for the exercise of every possible effort on the part of the community to bring it about.

Bend is not an isolated case. Lakeview, Oreg., is also apprehensive, and as time goes on there will be many others. Bend's Chamber of Commerce recommended, in brief—

> That every effort be made to secure the enactment of (1) Federal legislation making sustained-yield contracts possible, and (2) the appropriation of funds for the purchase program in the local timber area.

If public interests are to be safeguarded, there is need for both these things. The former is discussed on page 19; the latter on page 27.

THE LAKES STATES

In the West coast region (p. 8) total saw-timber stand is estimated at 628 billion board feet. In Minnesota, Wisconsin, and Michigan, to which the following applies, forest-survey data indicates a total saw-timber stand of 57.6 billion feet, board measure. Of this, Minnesota has 12.5 billion, Wisconsin 16.6 billion, and Michigan 28.5 billion.

Forest area in these three States occupies approximately 45 percent of all land surfaces. It totals 56 million acres and is about equal to the productive forest area of either Sweden or Finland. Approximately 40 percent of all land is in public, and 60 percent is in private, ownership. Its potentialities are great because of proximity to huge indus-

trial and agricultural centers of population, including the Middle West, and the high productivity of the land as indicated by its original forests.

But 11.2 million acres of forest land have been so abused that they now have no merchantable timber, and reproduction of commercial forest species occupies less than 10 percent of its surface. This means pretty thorough denudation of valuable forest growth. Another 18 million acres still bear merchantable timber, but far too little of it is mature. In these Lakes States generally there is too little advanced second growth to insure, under anything like present practices, sustained production of high-grade wood in the near future.

Lakes States white pine was once characterized as an inexhaustible forest resource. This region once produced its own requirements and dominated huge Midwestern markets. With current conditions as described, and with annual growth of saw timber computed at 1.8 billion board feet a year and annual drain at 2.4 billions, there may in the next few decades be an even greater shortage of certain species and qualities than is indicated by the fact that people there now import—largely over long and costly hauls—two-thirds of the lumber they use.

There is real need to rebuild forest lands and rehabilitate existing forests here. This could provide immediate work for people who need it. It could also provide more forest and forest-industry jobs in years to come. There is also urgent need to conserve existing supplies of merchantable timber, and the jobs they represent; to keep saw-timber drain below rather than above annual growth; to tide industries and dependent families and communities over until second growth becomes large enough for use.

Yet, of the nearly 16.5 million acres of Lakes States forest land in industrial and other (not farm) ownership, less than 100,000 acres (or 0.5 percent) are now under intensive forest management including sustained yield, and less than 1 million acres (5 percent) are under extensive forest management without sustained yield. Approximately 15.5 million acres (94 percent) are now in more or less productive condition, but except for providing fire protection no special effort is made by the owners to improve forest capital or growing stock. And on some 36 million acres of private forest lands—those in farm as well as in industrial and other ownership—protection from fire is only 50 to 75 percent adequate.

THE SOUTH

Generally speaking, the South (p. 3) includes 14 States. To relate to it current forest survey data now available, the South as here referred to includes, unless otherwise defined, a gross land area of some 213 million acres; all but small unsurveyed parts of Georgia

and Florida; all of Alabama, Mississippi, Louisiana; parts of South Carolina, Arkansas, Oklahoma, and Texas.

Despite 2 centuries or more of cultivation for such things as indigo, rice, sugar cane, and cotton, each of these States except Texas and Oklahoma still has more land in forests than in all other uses combined. Florida leads, with 71 percent forest land. Mississippi, though it trails, still has 54 percent. The average is 59 percent.

Next only to cotton, the South's forests have been her greatest single source of wealth. For more than 200 years they have supported industries producing such commodities as lumber, naval stores, poles, and piling.

The South as defined still has 125 million acres of forest land, but forests on most of it have been cut, slashed, and mined. Some 9.5 million acres are now so nearly devastated that they must be planted in order quickly to grow worth-while forests again. About 97 million acres bear second growth, but only half of it has trees of saw-timber size and most of it is seriously understocked. Of 18 million acres now in old growth, 11 million acres have been culled.

Despite all this the forest survey shows 264 billion board feet of saw timber and, in merchantable trees under sawlog sizes, 454 million cords of rough wood. Of the former, 56 percent is pine, and 44 percent (including cypress) is hardwoods. Of the latter, 34 percent is pine, and 66 percent is hardwoods. This forest resource is one of the South's most precious assets. Nature has been so kind that total annual forest increment (growth less natural mortality) of all species and sizes—computed at 48 million cords—exceeds the total annual commodity drain by some 7 million cords.

This figure can, however, be misleading. Much growth is in sizes unavailable for current use. Much is in low-grade hardwoods for which there is less demand than for pines. Rate of increment in the 35-million-acre naval stores area is only about half what it is in other pine regions. In the South as defined there were in 1936 more than 8,200 sawmills and 900 other wood-using plants. Current saw-timber drain exceeds by 1.25 billions of board feet the computed saw-timber growth of 13.25 billions of board feet. Certain areas are now reaching the point where some industries must be materially curtailed because of unwise use of the forest. In all the Southern States together, 15 new pulp mills have been established within the last 3 years. This makes a total of 45. These mills alone may require 5 million cords of rough wood annually.

So, though in the South as defined total annual forest growth of all species and all sizes exceeds total annual drain by 7 million cords, the picture is not too rosy. For although fire protection has been extended, and reforestation has increased in recent years, many southern forests have produced and grown without care from man and largely in spite of his indifference and abuse. Now old-growth and saw-

104402—38——3

timber stands are in general understocked. Yet from analyses made in many forest survey units of some 6 to 10 million acres each, it is known that forest growing stock in the South generally can be built up; that annual increment can be doubled, at least.

This is significant. It is estimated that in a single year forest industries in the South as a whole have provided work for about 225,000 people. If, through doubling increment, forest employment over the years could also be doubled, work might be provided for 450,000 individuals. In the South, forest and forest-industry pay rolls might then support more than 1,800,000 people.

No one can now say with certainty that this can or cannot be done. It seems pertinent, however, to record that one pulp mill in Florida is to produce southern pine sulphite pulp for use in rayon-pulp manufacture and that part of the production of a new mill in Louisiana is planned for bleached sulphate designed for use in rayon pulp. It may also be significant that although plant capacity for world production of chemical pulp is reported to have increased nearly 3,000,000 tons in the last 2 years, only 52 percent of this increase was in the United States; and that a new pulp mill in Louisiana, running to capacity will, it is estimated, require (in mill and woods) more than 800,000 man-days of labor each year. This—for one pulp mill only—is equivalent to 250 days of work for 3,200 people. And in the entire South there are 45 pulp mills now, and there were in 1936 more than 8,200 sawmills and 900 wood-using plants.

Nature, prodigal as she is, must be aided by man before southern forests as a whole can double their present growth. Fortunately most of the things man must do are obvious and rather simple. Adequate fire protection, for example, must be provided. The forest must be cropped rather than mined. It must be made to produce a wide variety of forest products. Growing stock must be built up. And these things must be done on all forest lands, no matter who owns them.

Progress has been made. Many private owners as well as States and the Forest Service have demonstrated that fire protection and better forest practices will increase growing stock and annual increment, and that these things can be done at a profit and will leave forest land in far better growing condition. But recent investigations indicate that intensive forestry, technically speaking, is confined to relatively few forest properties in private ownership in the South as defined on page 12; that although extensive forestry without sustained yield is now practiced on perhaps about one-quarter of the 125 million acres privately owned there, only a small proportion of all forest operators in the South can—except that they provide for fire protection—be included in these categories.

Investigations also indicate that (1) on some 23 million acres of the privately owned forest lands now in more or less productive condition,

no effort other than supplying fire protection is made by the owners to increase or improve forest capital or to relate mill capacity to the power of the land to produce forest growth; and (2) on some 72 million acres, or 60 percent, of all privately owned forest lands in the South (as defined) adequate protection from fire is still lacking.

It seems evident that the South still stands at the crossroads.

Except with respect to the character and extent of operations on privately owned forest lands, analyses—highlighted on previous pages—of current forest conditions in certain regions are based on the work of the forest survey. These analyses—and more detailed data now in constant demand by industries and individuals, State and county planning boards, public and private agencies generally—illustrate the need (1) for completing the forest inventory, and, as is done in Sweden and Finland, (2) for keeping it up to date.

The President's Message

On March 14, 1938, the President addressed to Congress a special message [1] about forests and forest lands. "I feel impelled at this time," he said in part, "to call to the attention of the Congress some aspects of our forest problem, and the need for a policy and plan of action with respect to it."

Human needs form the keynote of this message. "Forests," it says, "are intimately tied into our whole social and economic life * * * and some way must be found to make forest lands and forest resources contribute their full share to the social and economic structures of this country, and to the security and stability of all our people."

This approach is broad, democratic, and realistic. The message recognizes progress in private, State, and Federal forest practices, but it also recognizes that measures so far undertaken do not adequately meet the current situation. The President recommends study by a joint committee of the Congress itself; a study he hopes "will form the basis for essential legislation during the next session of Congress." He states, unequivocally, that "The public has certain responsibilities and obligations with respect to private forest lands," but adds, "so also have private owners with respect to the broad public interests in those same lands."

There is need, the President believes, to review methods of and opportunities for employment in forest work. Particular consideration, according to the Chief Executive, might well be given to cooperative relationships with private owners of forest lands and "cooperative efforts between the Federal Government and the States"; to "the need for such public regulatory controls as will adequately protect private

[1] Document No. 539, 75th Cong., 3d Sess.

as well as the broad public interests in all forest lands"; to "extension of Federal, State, and community ownership of forest lands, and of planned public management of them."

A Forest Policy

We now have within the continental United States some 168 million acres of noncommercial forest land and (p. 1) about 462 million acres that are commercial. Despite all that has happened, it seems probable that as a nation we need no more forest land now, and may not need more in the years to come. But we do need more and better forests. There is, therefore, need for a forest policy recognizing:

1. That on the whole this 630 million acres is and probably always will be more valuable in forest than in any other use.
2. That this 630 million acres must be adequately protected against damage or destruction by fire, insects, diseases, and quick liquidation.
3. That on this 630 million acres adequate forest and other cover must be restored where necessary, and maintained.
4. That on part of it—the 462 million acres of commercial forest lands—growing stock and productivity must be built up and maintained.
5. That though interests of private owners who comply with the Nation's forest policy must be protected, so must public interests inherent in all forest lands; that in private and public welfare there must be full and continuous use of all products, values, and services forest lands and their resources can and do render locally, nationally, and through world-wide markets.
6. That research—including research in utilization and economics in particular—is essential to full and continuous use, and must be so planned and executed as to help make the many wood products and byproducts of wood easily and readily available to consumers generally.
7. That since the forest resource is inextricably bound up with use of land for other agricultural purposes, forest management and use are integral parts of a unified agricultural pattern that must contribute fully and continuously to local and national social and economic structures.

A Plan of Action

The plan of action proposed in the President's special message (p. 15) is based on those human needs without which forest utilization is impossible and forest conservation meaningless. Its essentials are (1) public (State and Federal) cooperation with private

owners; (2) public regulation of forest land; (3) extension of public ownership and management.

PUBLIC COOPERATION

Public cooperation has to do with forest lands in private ownership. Of all commercial forest lands, those in private ownership total the best 341 million acres and constitute 90 percent of all potential forest-growing capacity. About 202 million acres are in industrial and other (but not farm) ownership. The rest, some 139 million acres, are farm forests.

If these forest lands are to help as they can and should to increase national wealth, and if private ownership of them is to continue, owners must conform to the Nation's forest policy. But as private responsibilities are recognized and redeemed, so also must those of the public be redeemed. Among these responsibilities are:

Protection.—Forests are subject to attacks by insects and diseases. These attacks sometimes do enormous damage. Control measures have been under way for years. Most funds have been Federal funds, often inadequate to accomplish the work on Federal lands alone. Neither forest insects nor forest diseases recognize property lines. When epidemics are threatened and when they occur, work is necessary on lands in private as well as in public ownership. Funds should come from both sources.

Forests are also subject to damage and destruction from fire. Lightning sets forest fires, but a great many are man-caused. Some start from logging; others from camping, hunting, and fishing by the public. Others are of incendiary origin. Besides protecting their own forest lands from fire it has, therefore, become a function of States to help private owners protect theirs, and these efforts have been supplemented on a cooperative basis by Federal funds.

Besides preventive measures, adequate forest-fire protection involves building and manning lookout towers so fires may be detected quickly; installing and maintaining telephone lines and radios so fires may be reported at once; constructing and keeping up roads, trails, and landing fields, and planning transportation, tools, and supplies so organized suppression crews may attack fire without delay.

In 1924 Congress authorized not more than 2½ million dollars to encourage and assist cooperative fire protection on lands in private and State ownership. The first Federal appropriation was made in 1926—$660,000, with $638,427.59 expended for this purpose. Recorded public funds expended for organized fire protection by the States reached $1,611,380.61 that year. Those reported by private owners were $263,512.58. Of the $2,513,320.78 total, expenditures by private owners therefore constituted 10½ percent; those by public agencies, 89½ percent.

In the fiscal year 1938, expenditures by States for cooperatively organized fire protection were $4,013,876. Those authorized under the (Federal) Clarke-McNary law were $1,610,000. Those reported from private owners reached $1,433,671, or about 20 percent of the total. There were additional unreported private expenditures, and the public expenditures mentioned do not include the fire-protection work done by the Civilian Conservation Corps on private and State-owned forest lands. As of March 31, 1938, this included construction of 38,937 miles of firebreaks, 1,020 lookout towers, 274 lookout houses, 28,787 miles of telephone lines, and 45,118 miles of trails and truck trails. The Civilian Conservation Corps also put in 472,278 man-days fighting fire on State-owned forest lands, and 1,068,627 man-days on forest lands in private ownership.

Real progress in fire protection has been made during the last 12 years. In 1926, 178,232,000 acres of private and State-owned lands were under organized fire protection. In 1937 the area reached 301,911,350 acres. In 1926 the number of fires reported on lands in State and private ownership was 87,190, with 23,539,500 acres burned over. In 1937, with 175,741 fires reported, the area reported burned was held to 21,890,730 acres. But 69 percent of these 1937 fires and 94 percent of the area burned were on some 182,762,920 acres still outside organized protection districts. On protected areas performance was excellent within some States, but records show it is not yet adequate within many organized districts in a number of States.

Reasonably adequate fire protection for all the 420,000,000 acres of private and State-owned forest lands needing it may require some 18 millions of dollars annually. This is equivalent to 4.3 cents per acre per year. It calls for increases in Federal as well as in State and private expenditures.

Forest Credits.—Credits for industry have in the past been derived from private sources. Lately these credits have in large measure dried up. This has raised the question of public or publicly sponsored credits like those available through the Farm Credit and Federal Housing Administrations and the Reconstruction Finance Corporation.

In general private credits to forest industries have tended to force quick liquidation of the basic forest resource. This has not made for the public welfare. There is need for public or publicly sponsored credits definitely adapted to forest industries. These should embody relatively long periods of time and low interest rates, and might logically be extended to owners who operate in accordance with national policies designed to protect the forest resource. Modeled along farm-credit lines, and with provision for administration by an accredited Federal credit agency, such legislation should form an integral part of a progressive program of public cooperation.

Taxation.—The property tax as applied to forest properties, in combination with liquidation policies, often brings disaster. As time goes on the tax base narrows, the rate goes up, liquidation is accelerated, owners and local governments commit suicide together.

In brief this has been the background of the property tax as applied to forest lands. Various modifications have appeared and have been adopted in a number of States, but from one standpoint or another all of them are open to serious objection.

Timberland taxation is a problem primarily within jurisdiction of State and local governments. It may be assumed that they and owners of forest lands will best be protected by taxation so applied as to encourage building up and maintaining forest productivity and continuous returns. One difficulty in getting such taxation lies, it seems, in the widespread policy of quick liquidation. So far, taxing agencies have been inclined to get while the getting was good. This has too often resulted in distress both to owners and to the public.

Equitable solution of forest-land tax problems depends on private owners acting in conformity with the Nation's forest policy. It also depends on a constructive approach on the part of private owners and mutual confidence between them and taxing authorities. It is inconceivable that owners who approach State and county authorities with a workable plan for sustained-yield forest management and who convince those authorities that they can and will operate on such a basis, should not get a square deal. Certain owners have tried this. They and local public agencies have found such procedures satisfactory. Both have expressed confidence in the future.

Unity of Management.—There are many regions in which the remaining forest resource is now partly in public and partly in private ownership. Within these there are many localities (p. 11) where unity of management can help to keep more ghost towns from coming into existence and can contribute security and stability to established and dependent industries and communities.

Legislation before the last Congress recognized this. It defined a method for pooling public and private timber provided the latter and the former were so managed as to insure compliance with the Nation's forest policy. To safeguard public interests it made appraisals and publication of them mandatory. Guaranteeing public hearings and the right to appeal, it also provided that public timber might be allocated to other than the highest bidder.

In this a choice was necessary. Forest resources in public and private ownership within a natural unit cannot be managed uniformly under a long-time plan without mutual concessions. It appears in the public interest for the Forest Service to concede certain orthodox procedure, and to be in position after appraisals have been made and published to reject the highest bid where such action will assure continuity, security, and stability to established and dependent commun-

ities within the unit. This concession on behalf of public interest should, however, be contingent upon definite, legal, and enforcible commitments by private owners, commitments assuring compliance with the Nation's forest policy.

Farm Forests.—Including noncommercial forest lands, there are approximately 185 million acres of farm-owned forest lands in continental United States. Annual yield from them is equal in value to the combined crops of barley, rye, rice, and flaxseed, and nearly equal in value to the tobacco crop. In 1934, farm forests contributed 62 million dollars in cash to more than 2½ million farm families, and 54 million dollars worth of such farm-used products as fuel wood and fence posts.

Like forests in industrial and other nonfarm private ownership, most farm forests have been abused; they do not now yield as they should. Unlike most industrial forests, most farm forests are in small units. Rebuilding and harvesting them are forest problems, but as essential parts of farm management these problems must be worked out through Federal, State, and local agricultural agencies and in cooperation with State foresters.

Congress recognizes that farm forests require special treatment. In addition to Federal assistance in fire protection, the Clarke-McNary law, passed in 1924, authorizes Federal cooperation with States to produce and distribute trees for planting by farmers. It also provides for farm-forestry extension and for investigative work in forest-taxation problems.

The calendar year 1937 saw 41,698,000 trees produced and distributed, with help from Clarke-McNary funds, in 40 States and 2 Territories, and 50,987 acres were planted. In farm-forestry extension the Forest Service cooperated with and gave assistance through the Extension Service and State agricultural colleges in 37 States and 1 Territory, employing 48 forestry specialists. Field demonstrations and meetings totaled 9,031.

Under its 1938 agricultural conservation program the Agricultural Adjustment Administration sets up a soil-building goal for each farm. Among ways of earning credits toward attaining this goal are (1) planting forest trees (and shrubs in protective plantings) provided they are protected and cultivated in accordance with approved practices, (2) caring for trees and shrubs planted between January 1, 1934, and January 1, 1938, and (3) with the prior approval of the county committee, properly managing existing farm forests. This program is exceedingly helpful. In some regions (the Lakes States, for example) it appears as if credits might be more widely applied for proper management of forested portions of farms.

In 1937 Congress gave added recognition to the vital part farm forests play in our agricultural economy, and to the need for special treatment for them. It recognized, too, fundamental differences be-

tween establishing, maintaining, and handling farm forests in areas where forests grow naturally, and in areas like the Prairie States. So the Norris-Doxey Act, which carries an authorization of 2½ million dollars, was made broad enough to permit Federal cooperation and aid in establishing shelterbelts and farm wood lots.

Techniques of shelterbelt planting in the Prairie-Plains region are forestry techniques, but the project itself has primarily to do with farm security. More than 200,000 farm families live in this region, and farm land and its improvements here are valued at more than 3 billion dollars. Experiences with old plantations indicate that farm wood lots and shelterbelts have helped materially to conserve soil moisture and increase yields of cultivated crops, prevent destruction of topsoil by wind, provide sorely needed shade and shelter for farm families and livestock, and furnish such products as fuel and fence posts. Records indicate that some lending agencies prefer to have shelterbelts on farms of Prairie Plains borrowers and lessees as greater surety for mortgages and leases. Some Federal land banks are urging shelterbelts on Prairie Plains farms taken over by them.

There was no appropriation for the fiscal year 1938 under the Norris-Doxey Act but the shelterbelt project was, with its relief features, continued with emergency funds. In cooperation with farmers who shared costs through contributions of labor, cultivation, fencing, and use of land, some 4,264 miles of shelterbelt strips were set out in six States. This involved planting 39,255,300 trees, shrubs, and nuts, including replacements. Because of better moisture conditions average survival should exceed the 65-percent drought-year results. As of June 30, 1938, some 60,000,000 seedlings were growing in nurseries for next year's planting.

In certain parts of Hungary upright wooden lattices are used to provide shelter, prevent desiccating winds from robbing the soil of moisture, and increase the yields of crops. In the Prairie-Plains States since 1935, and despite drought, grasshopper plagues, and dust storms, nearly 7,000 miles of new shelterbelts have been established. They are capable of protecting 2 million acres of cropland. Growth in some cases has exceeded 25 feet in height during the first 3 years.

Methods of planting these living lattices have been worked out and applied by foresters, but the project itself is one that primarily concerns farm security.

Research.—Scientific information is essential to successful management of forest and other wild lands and their resources so they may return greatest values and services. As conducted by the Forest Service, research has primarily to do with forests, forest management, forest economics, and uses and markets for forest products. It is applicable to forest lands in private as well as public ownership. Findings and results are available to individuals, industries, and public and private agencies generally.

104402—38——4

Research in forest management seeks how best to protect forests from fire, insects, and diseases; it lays foundations for tending forests, and for regenerating them naturally and artificially. It includes study and determination of improved methods of fire detection and control, and methods and means of growing, managing, and harvesting forest crops, including farm wood lots, pulpwood, and naval stores.

Economic aspects largely determine the extent to which good practices can be applied to farm forests, public forests, and those in industrial and other ownerships. One basic project in forest-economics research is the (p. 7) forest survey. Others concern forest taxation, tax delinquency of forest lands, forest fire insurance, land-and-resource utilization to help stabilize dependent industries and communities on the basis of permanent land-and-resource management, analyses of economic aspects of timber growing and harvesting, methods of organizing and operating cooperative farm wood lots, stability of ownership of forest lands, financing forest industries, and methods of marketing forest products.

Natural resources do not of themselves make a nation great, or a civilization secure. The modern economic order rests in large part on the ability to command gifts of nature and apply them to ever-increasing human needs. Research in forest products seeks to make existing methods of utilization more efficient and forest products cheaper, more diversified, and more satisfactory. It also pioneers in new fields of utilization.

Since they are essential to the basic problem, the Forest Service also conducts research in (1) matters having to do with plant cover in relation to water flow and erosion, and (2) others concerning the use of grass and browse, which occur in combination with timber and on the higher portions of many major watersheds. Research in the former includes intensive studies of the absorptive capacities of forest and other soils; the effects of misuse of land on run-off, and of windbreaks on air movements, temperatures, soil moisture, and crops. Range research determines when and how range lands can be grazed without injury to plant cover and soil; it helps determine forage values, grazing capacities, and range-forage-utilization standards; it aids to restore and rebuild depleted ranges and abandoned farm lands.

Research activities are directed through 12 forest experiment stations and the Forest Products Laboratory. They extend to 93 experimental forests and ranges that serve as outdoor laboratories and demonstration areas and to 33 natural areas. Many results of research may be seen on the various demonstration areas. Others are available through publications. Because of the size, scope, and importance of the many problems involved, the facilities now available are no longer adequate.

PUBLIC REGULATION

Among rights declared inalienable by delegates to the Continental Congress were those of life, liberty, and the pursuit of happiness. This is the foundation upon which a new Nation was built. In social as well as economic aspects these things form the framework of what we accept as the democratic way.

Civilization is more complex than it was in Thomas Jefferson's time, but liberty is just as precious. It is still necessary to safeguard it; yet we have learned that restraints are often necessary. Zoning offers one example. It restrains liberty but protects both the individual and the community.

Forests in the continental United States once grew on about 820 million acres. For more than 300 years they helped a young Nation expand, prosper, and mature. Lands capable of growing marketable timber now total 462 million acres. The best three-fourths is in private ownership, as is nine-tenths of all potential forest-growing capacity. Private ownership holds the key, therefore, to the welfare of millions of people who depend on forest resources, and on water from forest-covered slopes for irrigation, power, and domestic purposes.

Much more privately owned forest land is now under organized fire protection than was the case a decade ago, and protection is on the whole much more effective. Some private owners are leaving recently cut-over lands in better growing condition. In many regions a limited number of them are getting profitable yields more nearly in line with the power of the lands to produce adequate and continuous returns. These are the leaders. They are making real efforts to redeem their public responsibilities.

Private initiative and public cooperation have brought a measure of progress. The former should be encouraged. Under proper safeguards the latter should be increased. But the President's statement that these things "are not adequate * * * to meet the present situation" (p. 15) is justified. So is his suggestion that a joint Congressional committee give "particular consideration" to the needs for public regulatory controls with respect to privately owned forest lands. For the fate of the largest part of the best forest land in the United States is at stake. As a Nation we must adequately safeguard its productivity. To accomplish this, experience points to the need for exercise of a greater margin of sovereignty over it.

In the matter of traffic we welcome greater sovereignty. We have more safety and freedom with traffic regulation than we would without it. For years private owners of forest lands have sought and obtained public regulation to help prevent forest fires and to control those that start. In some States public agencies may suspend logging operations during heavy fire danger. In others, logging operations may be undertaken only under permits issued by a public agency. But as more

control of traffic is needed now, so is more control over private forest lands. It is needed in the public interest and to help protect leaders who, now cropping their forests, are subject to unfair competition from others who mine and exploit regardless of what values, or whose, are at stake.

In last year's annual report public regulation was proposed as a vital part of the forest policy for the Nation. It excited interest and discussion. Majority opinion within forest industries is probably against it, though some progressive leaders believe it necessary and inevitable. Public opinion, determined that exploitation must be stopped, seems largely in favor of it.

Discussion of public regulation has been helpful. Among other things it has focused attention upon the need, in cooperation with States, for Federal regulation of forest lands. In support of this viewpoint, discussion brought out that forest products are intermingled in interstate and intrastate markets; that, irrespective of State lines, forests help reduce the height of such floods as that of the Ohio, which in 1937 affected people in 243 counties in 10 States; that forests help prevent wind erosion, and silting of reservoirs vital to millions of people who, in many States, depend on water for irrigation, for power, and for domestic purposes; and that forests help prevent silting of streams and harbors used in transporting agricultural and industrial products from large sections of the country to domestic and world-wide markets.

In the light of these discussions the whole field of public regulation of forest lands has been explored. Even though the principle seems generally accepted by the public, there are honest differences of opinion as to methods and procedures. This was to be expected. There is, however, general agreement that regulation must be sound, economic, and democratic in concept, and that it should come as a result of standards openly arrived at.

The belief is also prevalent that, reflecting local needs and conditions, those standards must protect Nation-wide values and services; that, conserving broad public interests, they must, as President Roosevelt points out, "adequately protect private interests [in those lands] as well * * *"; that forest-land regulation must be sympathetic and fair, firm but flexible, and so clear, explicit, and easily understandable that adequate controls can and will be secured in the woods.

Proposals with respect to public regulation of private forest lands generally will be placed before the joint committee for such study by it as may, to quote from the Chief Executive's message, "form the basis for essential legislation during the next session of Congress."

PUBLIC OWNERSHIP

The need for public ownership and management of forest lands was recognized when the national forests, then called forest reserves, were established. Federal ownership and management have been reaffirmed by the Weeks law, the Clarke-McNary Act, and legislative enactments in many States. State legislation and local ordinances also provide for forests owned and managed by States and communities.

Public ownership and management of forest lands is an established policy. The degree to which this policy may be applied is discussed on pages 27 and 28.

Community Forests.—According to reports in 1933 there were in the United States 860 forest properties owned and under some form of management by such political subdivisions as counties, towns, and cities. A recent check indicates at least 1,500 community forests now in some stage of development and management, in 20 or more States. The total area involved may exceed 3,000,000 acres.

Community forests protect water supplies, provide opportunities for inspiration and inexpensive outdoor recreation, improve hunting and fishing, and grow timber for municipal and other uses. Demonstrating that, managed on a cropping basis, the forest can be used for all these things, most of them illustrate essential differences between forests and parks.

Newington, N. H., with 381 inhabitants, boasts what is said to be the oldest community forest in the United States. Established in 1710, this forest has helped to build a church, a town hall, a school, a parsonage, and a library; provided part of the funds for the village water-supply system; helped pay the minister's salary; supplied structural material for bridges and other purposes, and fuel wood. This Newington forest contains only 112 acres. That owned and managed by Newark, N. J., includes 36,000 acres and has yielded more than $17,000 worth of sawlogs, piling, fuel wood, and posts. An 800-acre community forest owned by Essex Junction, Vt., is said to show, now, a profit of $3,000 on the original investment.

But one of the greatest values of community forests is the opportunities they afford for replacing a public dole by worth-while work. Town forests in Massachusetts, for example, have provided more than 1 million man-hours of relief labor in the past few years. By building up and improving the properties, this work has increased the services and values derived by the public from them.

State Forests.—Like community forests, organized State forests are generally managed on a multiple-use basis. They are, in this respect, distinct from State parks. Since most State forests are larger than most community forests, they are not quite so near large centers of population. They should, however, be so well and widely distributed

that the public will have ready access to them for hunting, fishing, camping, hiking, and picnicking.

Records indicate 41 States now have 800 organized State forests, that State-owned land within them totals 10,802,700 acres, and that they are becoming more and more valuable in and of themselves and as a means of creating widespread interest in good forest management. Congress recognized these values and the need for more State forests when in 1935 it passed the Fulmer Act. This authorizes Federal purchases to help complete State-forest systems, with reimbursement by States from funds received from the sale of products and use of the lands. Management, under approved standards, is by the States. Since this act was passed, 32 States have qualified under it. The Forest Service has cooperated by helping to examine areas.

Federal Forests.—National forests are generally much larger than State forests and farther from centers of population. They are located on the flanks of the Appalachians from New Hampshire to Georgia, around the Great Lakes and headwaters of rivers like the Mississippi and Missouri, on the Great Smokies, in southern pineries, on the slopes of the Rocky, the Cascade, the Sierra Nevada, and the Coast Ranges between Canada and Mexico.

Including slightly more than 1,000,000 acres approved for purchase in purchase units, the national-forest system (p. 32) as of June 30, 1938, comprised 175,238,168 acres of federally owned lands. Established irrespective of State boundaries, these public properties are distinct from national parks in that they are administered on a multiple-use basis, with renewal of all their resources and values.

Today's national forests offer striking contrasts between civilization and wilderness, industrial activities and pastoral, material values and spiritual ones. More than 1,280 million feet of timber was harvested from them, under provisions that assure continuity of the forest stand, in the fiscal year 1938. They already provide a living for almost a million people and recreation for 30 million each year; are home and refuge for most of our remaining big game; include some 70,000 miles of fishing streams and more than 3,500 developed public campgrounds; furnish forage for more than 6,857,000 domestic livestock; help prevent floods and erosion; and provide domestic water for 6 million city people. They have a public transportation system that includes more than 138,000 miles of highways and roads and 153,000 miles of trails. Gross receipts from the national forests in the fiscal year 1938 were $4,671,133, with $1,178,883 returned to the States.

The national-forest system is interstate in character and purposes. It is large, but there are many huge watersheds outside it that still need protection. With no real indication that private owners are willing or able to undertake the job generally, there are also millions of acres of devastated, tax-delinquent, and abandoned forest lands

that need rebuilding so they may again support families and communities. There are also many areas within which existing forest industries and dependent communities are threatened by quick liquidation of the basic forest resource; where, unless preventive measures are taken soon, remaining forest resources may be so wrecked or crippled that they can only be restored largely at public expense. These conditions indicate the need for extending the present national-forest system.

Public Acquisition

THE extent to which public ownership and management of forest lands need be applied was analyzed in the Capper Report of 1920, and was also discussed in the Copeland Report in 1933. In 1934 it was analyzed again in the report of the National Resources Board. These investigations agreed on the need for a major program. There were differences of opinion as to the total area which should be acquired, but agreement that public ownership and management should embrace community forests, State forests, and national forests.

In 1937 another check was made. Confirming major conclusions of previous investigations and reaffirming the belief that in the broad public interests private ownership must be contingent on the compliance of owners with the Nation's forest policy, this check indicated 148,314,000 acres as the total of forest lands now in private ownership that should be acquired by public agencies generally. This is some 75,000,000 acres less than the Copeland Report figure and nearly 40,000,000 acres less than that suggested by the National Resources Board. It represents a long-time program.

The check indicates that, over the years, 47,950,000 acres might well be acquired principally as:

(1) Community forests. Such forests constitute a desirable form of public ownership and management.

(2) State forests. In most States a more adequate system of State-owned forests is needed. The Fulmer Act recognizes this in principle, but Congress has not yet provided the funds needed to make the act effective.

The check also indicates the need for a long-time program of Federal acquisition involving 100,364,000 acres for the national-forest system. Of this,

(1) 39,861,000 acres, now within national-forest boundaries, are essential and integral parts of existing and established national forests and purchase units;

(2) 19,550,000 acres, already examined, are vital to problems essentially interstate in character and scope. Reports on more than two-thirds of this acreage have been prepared for the National Forest Reservation Commission;

(3) 40,953,000 acres that, on the basis of the best data now available, probably should be acquired.

In continuing this program priorities should as far as possible be applied as indicated above. Continuity without such interruptions as have been experienced in the past will make for greater efficiency and economy. Break-down by broad regions of the proposed program for Federal acquisition is indicated on pages 33 and 34.

Federal ownership of forest lands inevitably raises the question of compensation to States and counties for loss of tax revenues. In this the Federal Government has as yet no consistent policy. No compensation is made in connection with millions of acres of forest lands in Federal ownership, yet 25 percent of gross receipts from national forests are returned to States and counties. This method of compensation is based solely on current income. It is unsatisfactory in that it provides little if any immediate return from lands that, cut heavily by private owners, have since been added to the national-forest system.

Compensation in lieu of taxes is a basic problem. There is urgent need for uniform application of a simple and direct solution that will provide—

(1) Current and stable income to counties within which there are forest lands that, previously wrecked or abused by private owners, are now being rebuilt and administered under Federal ownership and management;

(2) Additional revenues that will act as an incentive for communities and counties to help build up the productivity—on which such additional revenues shall be based—of the lands and their resources.

The Forest Service

THE basic purpose of forest conservation as a public policy is a social one. It relates to forest lands and their resources, but it does not consider trees, for example, as an end in themselves. It looks upon them as tools that, adequately maintained, help underwrite a permanent and a more prosperous civilization.

This, in brief, indicates responsibilities assigned by Congress through the Department of Agriculture to the Forest Service. Within this pattern its functions are to help make forest lands and their resources fully productive; to insure from them the maximum continuous services, products, and values that they are capable of yielding.

The responsibilities and functions of the Forest Service may be expressed as: (1) To initiate and apply, locally and nationally, action programs in the interest of public welfare and help with action programs initiated by county, State, and other Federal agencies; (2) to

protect, develop, and administer in the public interest the publicly owned national-forest system and all its resources, products, values, and services; and (3) to conduct research in problems involving protection, development, management, renewal, and continuous use of all resources, products, values, and services of forest lands.

Action Programs.—Some 95 percent of all the forest products we use each year come from privately owned forest lands. The best 74 percent of all commercial forest land is in private ownership. Many action programs administered for public welfare by the Forest Service, and many of those it helps correlate, coordinate, and apply, have therefore to do with forest and allied problems involved in private ownership.

Some of these programs are summarized on pages 21 and 22. Others include (1) cooperation with the Agricultural Adjustment Administration in connection with the range-conservation program and in examining in 1937 some 50 million acres of western range; (2) administration of the naval stores conservation program to help conserve forest resources and provide better yields from some 65 million acres; (3) cooperation with regional, State, and county boards in planning for better land use; and (4) cooperation with private owners and Federal, State, and other public agencies with respect to forest problems on lands that they own or that are under their jurisdiction.

The National Forests.—The national-forest system already supports almost a million people; when more fully developed and used it will be capable of supporting many more. Certain problems, and the work of the Forest Service in protecting, developing, and administering the national forests, are described on pages 32 to 54.

Research.—To contribute the maximum in permanent returns, management of forest lands and their products must rest on sound technical and economic bases. This applies to forest lands in public and private ownership alike.

Research as conducted by the Forest Service has already been summarized (pp. 21 and 22), and these investigations and their results are correlated, throughout this report, with certain forest problems and the work of the Forest Service. The results of this research, available to public and private agencies, individuals, and industries alike, are now widely applied. But the demands for basic forest research have become so great that current facilities fall far short of what are needed.

Decentralization.—The Forest Service is a decentralized organization. Most of its 10 administrative regions, each in charge of a regional forester, were established almost two decades ago. Its 12 regional experiment stations and the Forest Products Laboratory, each in charge of a director, have been developed over a long period. The primary purpose has been to provide close and constant touch with current conditions and problems in the States and Territories. To insure sympathetic and understanding approach, regional foresters

and directors act as consulting members of the Chief's staff in establishing broad policies and standards applicable to the Forest Service as a whole.

Performance in the field is checked through inspections and (p. 52) audits. Correlation and coordination are secured through special integrating inspections. These inspections are made from the Washington office, but the regional foresters and their staffs, all of whom are in touch with representatives of public (Federal and State) and private agencies and individuals within each region, make local application of the policies.

There are now 158 national forests. In charge of each, with but few exceptions, is a forest supervisor, directly responsible to 1 of the 10 regional foresters. National forests vary in size, but they average about 1,340,000 acres gross. Each is divided into districts that, varying with topography, work-load, and other conditions, average nearly 300,000 acres gross. The forest supervisor and his staff and the district ranger and his assistants are in personal touch with local organizations and individuals. With close and intimate knowledge also of national forests, ranger districts, and local situations and problems, these forest officers have the responsibility of protecting and developing each national forest and its resources and administering them in the public interest.

Personnel Management.—Seven percent of the 4,280 permanent employees of the Forest Service are in the Chief's office in Washington. The 93 percent in the field service are supplemented by thousands of seasonal or temporary employees. Methods of personnel management particularly adapted to the far-flung needs and situations of the Forest Service have been developed. During the year some 400 groups, among which were many temporary employees, participated in training camps, conferences, and seminars. In connection with handling large fires, which occur so seldom that men are often faced with grave responsibilities before they have had experience, a motion picture depicting the "one-lick" method of fire-line construction has been developed, as has a series of pictures covering other phases of fire suppression and control.

This year all the regional personnel officers met for the first time in Washington. Much attention was given to employee relations, including the following measures to help insure continuance of united and enthusiastic response: (1) An employee union that gives its representatives an opportunity to be heard on all problems under a form of collective cooperation that is distinct from collective bargaining; (2) a method for testing opinion on any subject so that misunderstandings between employees and employers may be eliminated and cooperation substituted; and (3) strengthening old and creating new "career ladder" opportunities and making them more widely available to women as well as to men.

Cooperative Relationships.—Existing between local people and local forest officers, cooperative relationships help solve local problems within the democratic pattern. These relationships are illustrated by 743 local associations whose members graze domestic livestock on national forests. With officers elected by members, and responsible to them only, these associations are free of any tinge of bureaucracy. Realizing their independence, these associations freely criticize policy and procedure. But criticisms are, on the whole, constructive. From them come suggestions that are invaluable to administrative officers whose responsibility it is to formulate policies and translate them into action; suggestions that help protect public interests as well as interests of the members themselves.

Forests, People, and Democracy

WITHOUT people forests are meaningless. Forestry can hide oppressive human treatment. It can, on the other hand, nurture an independent people, and this is a responsibility inherent in the management of all forest lands, no matter who owns them.

We have 630 million acres of forest land in the continental United States. About 90 percent of it is located in some 1,200 counties. So are half our farms and some 35,000,000 people. In these counties forest land makes up 60 percent of all land surfaces, and too much of it has been exploited. So have too many people. Aftermaths now include low living standards and undernourishment. Expenditures for public relief are enormous.

Many future citizens will come from these counties. Many people there are underprivileged, but they stem from fine pioneer stock. Their greatest need is for part-time jobs. Rebuilding and improving forest resources there can provide those jobs, but if the people in these forest regions are destined to peasantry for life, democracy will have failed.

THE CIVILIAN CONSERVATION CORPS

The Civilian Conservation Corps, trained to do many jobs, to know why each is worth while, and to know how and where each fits into the pattern of the whole, has made memorable contributions to a permanent and more prosperous civilization. It has built men as well as forests.

The total number of C. C. C. camps varied during the 12 months ended March 31, 1938. On an average, the Forest Service supervised the work of 767 of them. Members of 129 of these camps worked on lands in other than public ownership; those in 216 worked on State-owned forest lands; those in 21 worked on Tennessee Valley Authority

projects; and those in 401 worked on national forests. Major accomplishments are discussed in appropriate places in this report. Statistics may be obtained from the office of the Director of the C. C. C.

OTHER WORK PROJECTS

Other work projects planned and supervised by the Forest Service during the fiscal year 1938 included (1) the equivalent of 10,755 man-years of employment under the Emergency Relief Appropriation Act, with direct Federal allotments by the Works Progress Administration, (2) 225 man-years of employment, National Youth Administration, on projects sponsored by the W. P. A. Accomplishments include, in part, some 1,912 miles of range and other fences, 611 miles of telephone lines, 98 field radio stations, 686 miles of foot, stock, and truck trails, seeding and planting of 71,874 acres of forest land, and more than 40,000 man-days preventing and suppressing forest fires.

FOREST FOLK

National forests are huge work reservoirs. They already support almost a million people, but they also have underprivileged families. This is particularly true on lands purchased from owners who had previously exploited them. This condition creates a heavy obligation that the Forest Service is redeeming as resources at its command permit.

Last year's report described one of these areas. Three-quarters of the people there were tenants, sharecroppers, or squatters. They lived on little patches of land and raised meager home gardens. Ninety-eight percent of all houses had leaky roofs; 95 percent had no screens; only 1 in 10 had a toilet of any kind. Now many roofs are repaired, many steps and porches have been made safe, many windows screened, and many simple but sanitary toilets installed. Average cost, with labor, materials, and supervision included, has been less than $200 per family. With forest jobs, human as well as forest rehabilitation is under way.

The National Forests

The primary purpose of national forests is a social one: To assist in building a permanent and a more prosperous civilization by helping (1) safeguard present and future local and national needs for forest services and products and (2) protect watersheds, navigability of streams, and farm, industrial, and other values from damage by erosion, silting, and floods.

Authority to create national forests and add public lands to them was given to the President in 1891. Later restricted, this authority now rests solely in Congress with respect to Oregon, Washington, Idaho, Montana, Colorado, Wyoming, California, Arizona, and New Mexico. Since 1905 national forests and their resources have been protected, developed, and administered by the Forest Service.

Reaffirming the policy of Federal ownership and management of forest lands and resources in the common interest, Congress passed the Weeks law in 1911, and broadened it by the Clarke-McNary law in 1924. This authorizes the Secretary of Agriculture to purchase forested, cut-over, or denuded forest lands subject to (1) prior investigation and report, (2) approval by the National Forest Reservation Commission, (3) prior consent by State legislatures. Such consent has been granted by 38 States and Puerto Rico, usually without limitation but in some cases limited to specific parts of a State or to a maximum area within a State.

AN ACQUISITION PROGRAM

The national program for public acquisition and management of forest lands (p. 27) sets up 59,411,000 acres that, now within existing national forests, purchase units, and areas definitely desirable for purchase, should be added to the national-forest system. This has been carefully examined. Reports on most of it are ready for the National Forest Reservation Commission. The break-down of this acreage by broad regions is as follows:

Northeastern Region.—Some 1,240,000 acres within established national forests, plus 66,000 acres within established or planned purchase units.

Central Region.—About 4,372,000 acres within approved purchase units, plus 3,558,000 acres that, examined and reported upon, should help solve problems of flood and erosion control and economic maladjustment.

Lakes States Region.—There is urgent need for rebuilding forest lands here, and for maintaining their productivity. There is a relatively large acreage in State, county, and municipal forests. There should be more. But there are 5,048,000 acres of privately owned land within existing national forests and purchase units and another 35,000 acres near them that should be federally acquired.

Plains Region.—Some 438,000 acres within existing national forests, and 706,000 acres now outside established units.

Southern Rocky Mountain Region.—Within established national forests, 3,110,000 acres, and outside them, some 662,000 acres.

Region of the Columbia River Basin.—To simplify administration and promote unity of management, approximately 7,731,000 acres

within established national forests should be federally acquired. So should 1,363,000 acres adjacent to existing national forests.

California Region.—The program involves the purchase of 4,221,000 acres within national forests in this region.

The South.—There are 13,701,000 acres of privately owned forest lands that, within approved national forests or purchase units, should be made integral parts of them. And although a progressive minority of private owners has made real progress in forest management, detailed examinations indicate some 13,160,000 acres more that, in the public interest, should be added to the national-forest system.

CURRENT PROGRESS IN ACQUISITION

Forest land in private ownership may be acquired for addition to national forests through exchange, purchase, donation, and transfer. Forest and watershed public domain may be added through boundary adjustments. A summary of the progress made during the fiscal year follows.

Exchange.—Under acts of Congress, privately owned forest lands may be acquired through exchanges of not more than equal values of national-forest land or stumpage in the same State.

Exchanges with Michigan contributed to effective and economical management of State and national forests. Under one exchange, previously approved, the State conveyed 23,357 acres and received 20,085. Through six more not yet approved, Michigan will convey 133,034 acres, valued at $403,396, and receive 70,621 acres, valued at $403,389.

In all, 84 exchanges were consummated during the year. The United States acquired 242,679 acres valued at $1,447,206; granted 28,959 acres valued at $73,343 plus 581,899,000 board feet of national-forest stumpage valued at $1,124,119. Net gain in national-forest area was 213,720 acres. In addition the Secretary approved and referred 151 exchange cases to the Secretary of the Interior. They involve 200,575 acres of private land valued at $823,834, 14,284 acres of national-forest land valued at $60,832, and national-forest stumpage valued at $600,459.

Exclusive of certain early cases, the total number of exchanges completed to June 30, 1938, was 1,370. The United States acquired 2,242,288 acres, valued at $8,605,451; it gave in exchange 539,705 acres valued at $2,253,377, and 2,113,648,000 board feet of stumpage, valued at $5,021,644. Unit values of stumpage thus acquired have increased, and better protection and management have been obtained at lower costs. The net gain in national-forest area brought about by all the exchanges completed by June 30, 1938, was 1,702,583 acres.

Purchase.—The National Forest Reservation Commission held five meetings during the year and approved for purchase a total of 800,113

acres at a cost of $2,712,762. During the year 1,433,078 acres were vested in Federal ownership. The area purchased now totals 15,672,-612 acres. With 2,710,125 acres reserved from the public domain, transferred from other Government agencies, or acquired by donation, and 267,336 acres acquired through exchanges, Federal holdings acquired through the Weeks and Clarke-McNary laws now amount to 18,650,073 acres. An additional 1,068,299 acres is in course of purchase. Details are given in the annual reports of the National Forest Reservation Commission.

The Bates College Experimental Forest, in Maine, has been renamed the Massabesic Experimental Forest, and a moderate expansion has been authorized. Purchase in the Uinta and Wasatch National Forests, for which special provision was made, has been extended. Purchases under Weeks law as amended are ordinarily restricted to established purchase units. Establishing additional units or enlarging existing ones is not favored by the National Forest Reservation Commission until funds more nearly meet requirements than is the case with annual appropriations of only $2,500,000 to $3,000,000.

Donation.—During the year, 44 tracts embracing 2,847 acres were donated and accepted by the Secretary for national-forest purposes. The total donated, to June 30, 1938, including administrative sites, was 297,639 acres.

Transfer.—To adjust land occupancy and use, the Resettlement Administration and its successors have purchased submarginal land. Some of it, chiefly valuable for forest purposes, has been transferred to the Forest Service. Transfers made by the President during the fiscal year include 368,678 acres from the Wakulla, northeast Georgia, Piedmont Georgia, west Alabama, Drummond, Crandon, Ausable, and Lakewood projects to the Apalachicola, Chattahoochee, Talladega, Chequamegon, Huron, and Nicolet National Forests.

The Secretary of Agriculture, under Executive Order 7530 of December 31, 1936, as amended, and title III of the Bankhead-Jones Farm Tenant Act, assigned to the Forest Service for administration six land-utilization projects originated by the former Resettlement Administration in Washington, Oregon, New Mexico, Colorado, and Missouri. They have an aggregate gross area of 1,030,066 acres, of which 469,601 are owned or in course of acquisition by the United States. Presidential authority to create or add to national forests still applies in Missouri, but national-forest status for units in Washington, Oregon, New Mexico, and Colorado must come through Congressional action.

Boundary Adjustments.—Inclusion within national forests of such public-domain forest and watershed lands as are geographically and economically integral parts of national forests, will assure protection and management at lower costs, reduce the number of Federal agencies with which the public must deal, and help solve control problems of land use and management.

This inspired most of the 58 bills introduced in Congress during the fiscal year to adjust national-forest boundaries. Action on many was deferred largely because of differences in viewpoints and philosophies. Congress did, however, enact bills adding to the Kaniksu, Black Hills, Rio Grande, Trinity, Ochoco, Columbia, and Snoqualmie National Forests a gross area of 272,111 acres (96,191 acres net), and extended provisions of the general-exchange act to related private lands. Three other bills extended provisions of the general exchange act to 857,090 acres adjoining the Klamath, Lassen, Modoc, Plumas, Shasta, and Tahoe National Forests, Calif., and authorized the President to add 47,799 acres owned there by the United States.

The act creating the Olympic National Park reduced the Olympic National Forest by 648,000 acres. Another act transferred 38 acres from the Tongass National Forest to the University of Alaska for an experimental fur farm; and 6,408 acres were eliminated from the Coronado National Forest and added to the Chiricahua National Monument.

ABSTRACTING

Abstracting and land title records are parts of acquisition. In regions 7, 8, and 9, 1,868 cases, involving 596,958 acres, were accepted for acquisition. Approximately 88 percent of the abstracting work on these cases has been accomplished, and in 21 percent of the cases title has been vested in the United States. Fewer cases are being submitted for condemnation, and improvement has been noted in the dispatch with which all cases are handled.

NATIONAL-FOREST PROPERTIES

As of June 30, 1938, the national-forest system (p. 26) included 158 national forests, plus 37 established purchase units formally approved by the National Forest Reservation Commission. Additions to national forests during the year were offset by three eliminations that (unreconciled by pending surveys) involved 652,146 acres net. With basic statistical material heretofore included in the annual report, tabular compilations of the year's additions to and eliminations from national forests are now included in Section Z, Administrative Statistics. Requests (p. 55) for this section should be addressed to the Forest Service, Washington, D. C.

Within a gross area of 227,280,025 acres in national forests and purchase units are 175,238,168 acres of national-forest lands. In addition, jurisdiction over 1,030,066 acres gross (within which the Department of Agriculture has taken steps to acquire 469,601 acres) has been assigned to the Forest Service for administration and protection. Not counting certain areas awaiting title clearance before final payment can be made, included in each of the above net-area figures, the total

net area now under jurisdiction of the Forest Service is 175,707,769 acres.

Protecting the National Forests

Most national-forest resources and values are subject to damage and destruction by fire. Many fires are set by lightning, but altogether too many are man-caused. Timber on national forests is subject to attacks by forest insects and diseases. When epidemic proportions are reached they often cause enormous damage.

PROTECTION FROM FIRE

Lightning set 5,470 fires in or adjoining national forests during the calendar year 1937, and 6,195 were man-caused. More than 72,200 national-forest acres were burned over. The damage is estimated at $151,380.

Human ingenuity has not yet devised any way to prevent lightning from starting forest fires, but most man-caused ones are due to carelessness and neglect. Since it should be possible to eliminate them, prevention is the first step in forest-fire protection.

Fire Prevention.—Fire prevention is carried on by planned educational campaigns in cooperation with newspapers, radio stations, motion-picture theaters, and civic and other organizations. It involves exhibits, lectures, pamphlets, literature, and admonitory signs. In part for their own protection, visitors to many national forests may be registered during the fire season, and may be required to equip themselves with simple fire-fighting tools. During dangerous periods and in dangerous localities campers may use fireproofed campgrounds only, and smoke only at places of abode and others specifically designated. It is sometimes necessary to regulate or prohibit travel for short periods in certain areas. Every effort is made to apprehend and prosecute persons responsible for starting forest fires.

In these activities the C. C. C. helps. It also reduces fire hazards by removing inflammable material along roads and trails, and constructing and maintaining roads, trails, telephone lines, and lookout towers (p. 17) essential to protecting national forests from fire.

Fire Suppression.—The 1937 fire season was disastrous from the standpoint of loss of life, but losses of area by fire have never before been held to so low a total. The average for all regions was only 500 acres burned per 1,000,000 acres protected.

In this many factors played a part. One was increased appropriations. Another was research, including developments that, for example, make possible quick and reliable measurements of fire

danger and increased efficiency at lower costs for detection, communication, and transportation. A third was the advance in the science of fire control. Cumulative efforts to secure better public understanding and support helped to reduce the number of man-caused fires to 53 percent of those in 1936. The fire suppression work done by the C. C. C. was invaluable, and 15 heroic C. C. C. boys lost their lives. But a share of the credit for the 1937 fire record must in all fairness be ascribed to relatively favorable fire weather.

Special measures to guard against surprise fires and strengthen the fire-control structure were mentioned in last year's report. Among them was a light motor-driven power tool for clearing fire lines. Tests indicate that this machine may prove of major importance. Certain radio equipment designed by the Forest Service has become a commonplace feature of fire detection and suppression. The number of sets on national forests is now about 2,500. A two-way radiophone unit for trucks and other vehicles is in production, and Congress has provided the impetus that may make the autogiro a large factor in forest-fire suppression.

As the honor roll discloses, 15 men met horrible deaths in the Blackwater fire or died afterwards from injuries received there. Thirty-eight others were injured but recovered. Exhaustive analyses, started before this fire was out, disclose that the tragedy was due to an unforeseeable combination of sudden changes of weather plus the fact that timber immediately above the fire line had not "crowned out" when its ground fuels burned. As a result the burned space above the fire line, which should have been a refuge when wind-driven spot fires swept up from below, actually reburned. This deprived crews of what should normally have been a nearby safety zone. Experienced forest officers and foremen are always on the lookout for such deadly combinations of adverse circumstances. Occasionally, however, no degree of vigilance or judgment is sufficient to guard against risks that are part and parcel of forest-fire suppression.

The Honor Roll.—The 1937 honor roll of men who died on far-flung national-forest fire lines or from injuries received on them is a heavy one. It includes 20 men: Alfred G. Clayton, Paul E. Tyrrell, James T. Saban, Rex A. Hale, Clyde Allen, Roy Bevans, Ambrocio Garza, John B. Gerdes, Will C. Griffith, Mack T. Mayabb, George E. Rodgers, Earnest R. Seelke, Rubin D. Sherry, William H. Whitlock, Billy V. Lea, Andrew D. Lindgren, Fred Dunlap, Albert A. Bomar, G. F. Carmichael, and Lloyd G. Hornby.

The 15 men listed first met death in or as a result of the Blackwater fire on the Shoshone National Forest; the last 5, in the order listed, from fires on the Huron, Nicolet, Shasta, Roosevelt, and Clearwater National Forests, respectively.

PROTECTION FROM INSECTS AND DISEASES

Damage to national-forest timber by several different species of bark beetles and other destructive forest insects continues. Control measures were necessary during the year to protect red spruce on the Green Mountain National Forest, in Vermont, from an infestation of spruce bark beetle. Bark beetle attacks in ponderosa pine in Colorado and in lodgepole pine in Colorado and Wyoming made sizeable control measures necessary. Smaller projects had to be initiated in other western national forests.

The national-forest area treated during the year because of insect attacks totaled 421,000 acres. Treatment was applied to 55,485 trees. Surveys and scouting to detect and locate incipient outbreaks, so control might be applied early, were continued. Close cooperation was maintained with the Bureau of Entomology and Plant Quarantine.

Control of white-pine blister rust in commercially important white-pine-producing areas in the East has progressed. The situation is serious, however, and the hazard is still great in western white pine within the "Inland Empire" and in sugar pine within parts of Oregon and California. The disease here is particularly virulent, and young reproduction of both western white and sugar pines is highly susceptible.

Treatment has extended to 2,152,700 acres of national-forest lands, but an estimated 1,775,300 acres of five-needled pine-producing land have not been given even an initial treatment. Of this, about 1,000,000 acres are in the sugar-pine region of California and Oregon, and about 500,000 acres lie in the western white-pine region of northern Idaho, western Montana, and eastern Washington.

During the year initial treatment was given to 56,800 acres, and on 28,900 acres repeat treatments were made. Of the total, 30,500 acres were treated by the C. C. C. Expanded control programs are essential if the spread of the disease is to be checked and pinelands kept productive. Serious losses in future timber production can be averted only by concentrated work during the next 2 years.

Administration and Development

National forests, purchase units, and certain other areas (p. 36) now in Federal ownership constitute an area larger than Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Delaware, Pennsylvania, Ohio, Indiana, and half of Illinois. Part of the responsibility of the Forest Service (p. 28) is to administer and develop these public properties within which land and water are basic to such other resources and

assets as timber, forage, wildlife, and recreation, and the many services they render to individuals, communities, States, and the Nation.

LAND

In this no clear-cut distinction can be drawn between land itself and other resources, assets, and services essential to a permanent and prosperous civilization. There are, however, certain processes that so directly concern land that it seems logical to report upon them here.

Surveys and Maps.—Accurate maps are essential for adequate and efficient protection, development, and administration of land and resources. Maps have already been prepared for most national forests and purchase units, but much of the data originally available was inaccurate. For certain other areas practically no map data have been available; so additional surveys are necessary. In making them the aerial-photographic method is generally used. Pictures thus secured are also invaluable in fire control, for range surveys, and for determining distribution and density of timber stands. Forest Service mapping conforms to standards of the Federal Board of Surveys and Maps. Aerial photographs during the year covered 20,550 square miles. Topographic and drainage surveys by ground methods covered 2,930 square miles.

Highways, Roads, Trails, and Landing Fields.—Forest highways, primarily for public travel between cities and towns, are essential parts of national and State highway systems. Development roads or truck trails supplement local road systems and permit the transportation of forest products, minerals, etc., to railroads, main highways, and communities; provide ingress and egress for domestic livestock and for hunters, campers, fishermen, and others. Horse and foot trails extend the transportation system into "back country" within which—since fire danger requires rapid transportation of men, supplies, and equipment—trails are supplemented, where possible and necessary, by airplane landing fields.

Planning correlates and coordinates the entire transportation system and relates it to local needs. Funds for the construction and maintenance of forest roads and trails during the fiscal year included: (1) The 10-percent fund, which totaled $485,818.80; (2) appropriations under the forest road and trail item of the Agriculture appropriation bill (and in accordance with section 23 of the Federal Highway Act of November 9, 1921), which totaled $12,500,000 ($8,150,000 for forest highways and $4,350,000 for the development roads or truck trails); (3) cooperative funds, provided mostly by the States, totaling $742,192.

Expenditures and contributed time of agencies other than the Forest Service, evaluated at $5,952,863, were also used. Most of these con-

tributions were by the C. C. C., which constructed 1,436 miles of truck trails, and 342 miles of horse and foot trails on national forests and maintained 26,767 miles of the former and 12,117 of the latter.

The planned national-forest transportation system includes 24,175 miles of forest highways, 113,396 miles of forest development roads, 152,840 miles of horse and foot trails, and a number of airplane landing fields not yet determined. Of the highway and road mileage, some 46 percent has been completed to satisfactory standards. Approximately 78 percent of the trail system is also completed. To December 31, 1937, 66 landing fields had been used. Estimates indicate the need for some $417,000,000 to complete construction and betterment work on national-forest highways, roads, and trails. Of this about $291,800,000 is for forest highways, $120,800,000 for development roads, and $4,400,000 for trails. Details by States are included in Administrative Statistics, mentioned on page 55.

Settlements, Claims, Special Uses.—Final application for patents for homesteads in national forests totaled 112 during the year. On these, 96 favorable reports were made and 16 unfavorable ones. Final application for mineral patents to lands in national forests totaled 77 during the year. On them, the Forest Service made 56 favorable reports and 21 unfavorable ones.

Active special-use permits for small areas of national-forest lands totaled 40,722 last year. This fiscal year the number was 41,293. Rental charge was made on 22,112 of last year's permits and on 22,348 of this year's. The remainder were, in both years, issued without charge. Special-use receipts for the fiscal year totaled $366,267.62.

Northern Pacific Land-Grant Suit.—The Northern Pacific land-grant suit involves the claim of the company for damages because it was denied the right to select 2,800,000 acres of land within its indemnity limits in Wyoming, Montana, Idaho, and Washington. In March 1938 the report of the special master, appointed to adjudicate the company's equities, was reviewed by the United States District Court at Spokane, Wash. Decision of the lower court was adverse to three company claims and to two contentions of the United States. Under the act of May 22, 1936, either party to the suit may appeal directly to the United States Supreme Court on legal points. Appeal is anticipated. If the Supreme Court sustains company claims the next step will be to determine the value of the lands in which the company is found to have equitable interest. Prospects of a final decision at an early date are remote.

WATER

One major purpose of national forests is to secure favorable conditions of water flow. This has been and is an important consideration in the acquisition program (p. 33) and in protecting, developing, and administering national forests generally.

Uses of Water.—Almost every major stream west of the Great Plains heads in some national forest. So do most minor ones. Water from their protected slopes is indispensable for:

(1) Domestic purposes. Nearly 400 cities and towns (including Portland, Oreg., Los Angeles, Calif., Salt Lake City, Utah, Prescott Ariz., and Denver, Colo.), get domestic water from national forests. They have water investments totaling close to half a billion dollars.

(2) Irrigation. The 1930 census shows within 11 Western States some 932 million dollars invested in irrigation enterprises. Almost 90 percent is based on water from national forests.

(3) Power. More than 11 million potential horsepower is from water that originates in national forests. That developed and applied for will, it is estimated, involve an investment close to 1¾ billions of dollars.

Much national-forest water power is used by industries miles from the source, but there are many opportunities for developing more local industries using more local power. Possibilities for pulp and paper manufacture and electrochemical processes in southeastern Alaska offer an outstanding example. It is estimated that 250,000 horsepower is available in or near pulpwood forests capable of a sustained output of 1 million tons of newsprint each year.

In cooperation with the Federal Power Commission, the Forest Service handled 42 applications for water-power permits or licenses involving the use of national-forest lands during the year. This was 74 percent of the current number received by the Commission. At the end of the year the Forest Service was administering 444 permits and licenses for the Commission and had made monthly reports on 84 projects.

There are still in effect 182 active permits and easements issued by the Forest Service prior to the passage of the Federal Water Power Act. Of these, 98 are for power-generation projects with combined estimated average low-flow output of 335,401 horsepower and a combined estimated installed capacity of 685,255 horsepower, and 84 are for transmission-line projects with a length of 744.4 miles within national-forest boundaries. During the year annual rental fees were charged on 54 power projects (estimated low-flow output, 317,092 horsepower) and 70 transmission-line projects (length, 641.2 miles). No rental fees were required on 44 power projects (estimated low-flow output, 18,309 horsepower) or on 14 transmission-line projects (length, 103.2 miles).

Shortly after the end of the fiscal year the Attorney General held that authority to issue licenses or permits for operation of electric-power-distribution lines in national forests rests with the Federal Power Commission.

Flood Control.—To most people flood control means strong levees, deep channels, and huge reservoirs. It is difficult to apply a yardstick to the services they perform, but we know we need these man-

made structures to help confine angry waters, prevent widespread human misery and property damage, and save lives.

National forests also render services with respect to floods. Their forest soils absorb moisture readily, hold a great deal of it in hills and mountains, then release it gradually so flood crests may more nearly be kept within the bounds of man's mighty downstream engineering works.

That is why as a Nation we are turning from rivers to rivulets, from ramparts to sources from which floods come. We still recognize the value of major engineering works. They must be continued and expanded. But we must also have such common-sense measures as reforesting and regrassing of land unfit for cultivation; protection of existing forest and grassland cover, and controlled use of them. For these things, based on research and applied to watersheds where floods have their origin, help save soil for productive use; help eliminate recurring minor floods; help reduce the velocity of surface run-off that contributes to major floods; help reduce damage to farms and industries in the lowlands and the silting of reservoirs and navigable streams.

Cooperating with the Flood Control Coordinating Committee of the Department of Agriculture, which in turn cooperates with the War Department, the Forest Service is actively engaged in examining watersheds. And within national forests, largely through the assistance of the C. C. C., the Forest Service is applying positive measures that help control soil erosion and the too-rapid run-off of water.

TIMBER

Timber, like other national-forest resources, is developed and administered so it may afford maximum opportunities for employment and contribute continuously and as fully as possible to stable community life.

For years selective logging has been a standard national-forest practice in certain forest types. One exception has been in the Douglas-fir type. Here in the past clear cutting was usual on national forests and land in private ownership, but within the last decade powerful trucks and tractors have made selective logging physically possible. A few years ago the information accumulated by research and administration indicated that, from the standpoint of economics as well as from that of silviculture, it was possible to apply within some of the Douglas-fir type a selection system modified to fit that type. That modified system is now adopted, as conditions and circumstances make it possible, in Douglas fir on the national forests. It is being tried out also on certain private holdings.

To help nature increase growth and value of timber stands, most forests need cultural operations. Much of this has been done by the

C. C. C., but there are millions of acres that still need it. The need, for example, for harvesting timber from relatively small areas or those on which the stand is relatively light, and for harvesting low-grade material, indicates the desirability of authorizing the Forest Service to conduct logging operations and offer unprocessed forest products for sale on the basis of roadside delivery. Such authorization would permit harvesting certain forest stands unattractive to private industry and would provide employment for local people in need of jobs. Authorization should, however, be used sparingly and only if after roadside delivery the products can be sold for not less than cost plus a reasonable stumpage allowance.

As is indicated on page 19, there is also need for legislative action that will make unity of management practicable for forest lands that, in adjacent or intermingled private and public ownership, lie in natural topographic and economic units.

For years research has enabled foresters to write for most major types the few simple rules that, properly applied, will keep forest lands productive. More than this preliminary step is necessary, however, before forests can be continuously harvested so as to bring security and stability to dependent families and communities. For a few types the more detailed information necessary to intensive forest practices is becoming available. In the western white pine type of the northern Rocky Mountain region, for example, we now know that it is silviculturally feasible to apply three methods of harvest cuttings—clear cutting, scattering seed tree, or shelterwood—provided economic conditions permit and each method is employed under the proper site conditions. Another example of progress in research concerns Lakes States jack pine. This species has been hard to regenerate after logging. It now appears that mechanical scarifications of soil prior to clear cutting or heavy cutting, plus the scattering of cone-bearing branches over the area after such cutting, seems necessary if adequate regeneration of the species is to be obtained.

Research in tree breeding carried on by the Forest Service to secure superior strains for planting or for natural reproduction shows promise. Within the last year or so similar programs have been started at Harvard University, by the Dominion Forest Service in Canada, and by at least one private organization interested in wood products.

Sustained Yield.—Plans were prepared during the year for a number of working circles. Wherever such circles are adjacent to private holdings the policy is to sell national-forest timber only at such times and in such a way as to help convert private operations to a sustained-yield basis. In a number of cases, however, quantities in working circles are relatively small, and sales of mature timber and advanced second growth may be made to established mills provided operations (1) contribute to welfare of local families and communities, and (2) increase the quality and rate of growth of the remaining stand.

The Sublimity circle on the Cumberland National Forest, Ky., was one of those established last year. It provides an annual cut of 5 million board feet on a sustained-yield basis. In accordance with his contract the purchaser gets part of his labor from residents on the Sublimity Resettlement Project.

Developments in the Prineville working circle, Ochoco National Forest, Oreg., include the acquisition by the Federal Government of 20,925 acres of virgin ponderosa pine. A cooperative agreement calling for unity of management with respect to certain private holdings and national-forest timber is an essential feature of the purchase. After being cut under approved standards, company lands will be offered to the Government in exchange for national-forest timber. In return for this concession the Forest Service agrees to make available national-forest timber that will round out an operation the average annual cut of which shall not exceed the sustained-yield capacity of the working circle.

Timber Sold and Harvested.—Most national-forest timber sales are small. Each operator pays for stumpage in advance of cutting but does not have to pay in advance for the total amount covered by his contract. This makes timber available to individuals and small local concerns who may not have much working capital.

During the fiscal year 21,916 national-forest timber sales were made. Of these, 20,440 amounted to $500 or less. The stumpage involved in all sales was equivalent to 1,074,916,000 feet, board measure; that involved in sales and exchanges was equivalent to 1,094,599,000 feet, board measure. Timber cut under sales and land exchanges totaled 1,287,917,000 feet, board measure, with receipts of $3,066,694. National-forest timber-sale business is shown by States in Section Z, Administrative Statistics. Dead and down national-forest timber is customarily granted free to local settlers for personal use.

Planting.—More than 4,500,000 acres in national forests must be planted before they can produce crops of merchantable timber. Much of this land is in localities where there is urgent need for employment. Planting would, it is estimated, provide more than 13 million man-days of labor and make this 4½ million acres productive again. Yet current appropriation for national-forest planting is only $400,000 a year. This is inadequate to accomplish the job within any reasonable time, even though full advantage is being taken of C. C. C. and other emergency labor and funds.

The Forest Service operates 26 national-forest nurseries. From them, during the calendar year 1937, 147,166,000 trees were distributed. Of these, 136,809,000 were used for national-forest planting; 10,357,000 were supplied to other Federal agencies, and to States for distribution under the Clarke-McNary law. National-forest field planting during 1937 totaled only 155,744 acres. In 1936 it was

214,306 acres. Direct seeding amounted to 683 acres in 1937. In 1936 it was 8,769 acres.

Cumulative results through research in seeding, planting, and nursery work are invaluable. Current studies indicate, for example, that specific gravity is a reliable index of the time when seeds are ripe and cones ready to open. This, and improved methods of extracting longleaf pine seed in kilns, should make it possible to avoid waste. Nursery and planting techniques, demonstrating that survival may be increased as much as 50 percent in severe seasons by proper choice of stock for field planting, should make it possible to reduce planting costs.

To date the Forest Service has planted 897,642 acres on national forests. Of this acreage, some 75 percent shows promise of bearing satisfactory stands of timber. Despite every care to get the right species and age classes of planting stock grown from satisfactory seed sources, and to use the best-known field planting practices, replanting—due in large part to deterioration caused by fire and erosion—has been or is necessary on 25 percent of this area.

Besides initiating timber production, planting improves watersheds and helps prevent erosion, contributes to recreational values, and is coordinated and correlated with wildlife management. Current annual output of national-forest nurseries, and total national-forest area planted and sown by States, are included in Section Z, Administrative Statistics.

FORAGE

Forage—in the form of grass, weeds, and browse—is a major national-forest resource; it supports wildlife, in itself a resource, and domestic livestock. Like timber, forage is renewable. On national forests it is cropped on a sustained-yield basis and so managed as to obtain maximum benefits for dependent families and communities. This requires correlation of use with use of forage on adjacent lands. Since use of national-forest forage by wildlife is summarized on pages 49 and 50, the following discussion is confined to forage in relation to use by domestic livestock.

Early Administration.—When the first national forests were created most Western States were only partially settled; conditions favored large livestock operations. When in 1905 administration was transferred to the Department of Agriculture, most national-forest ranges were already occupied by cattle and sheep. Many early grazing permits, recognizing prior use, were therefore for relatively large numbers of stock.

Between 1905 and 1914 the West was settled rapidly. Many ranges outside national forests were fenced. Partial or total liquidation of many large outfits ensued. Needs for national-forest range by settlers and other new applicants were not difficult to satisfy during this

period. Increases during the World War totaled 180,000 cattle and 870,000 sheep, but wartime pressure forced too heavy stocking of many ranges. This required protection reductions, but it was impossible to allot much range to new permittees.

In 1925 came more fencing of outside ranges acquired under the Grazing Homestead Act, with heavy demands from new applicants. National-forest term permits were instituted. When the term-permit period ended, in 1934, the needs of new applicants were acute. Reductions in established permits were made. They affected 1,100 cattle permittees and 500 sheep permittees, and a total of 15,500 cattle and 100,000 sheep. But the range gained met only a small part of the needs of new applicants and small users. Extended droughts, decrease in forage production, and further range-protection reductions, indicated the need for thorough study of the whole situation.

Distribution Survey and Policy.—The distribution survey, summarized in last year's report, is completed. Its findings and conclusions have been discussed with livestock and related groups. Criticisms were frank, suggestions helpful. Policy, being analyzed and discussed, places emphasis on such range management as will contribute the maximum to restoration and perpetuation of forage values on national-forest ranges and related lands. Stability is provided for. The size of future permits is governed by three classes of limits, to be determined locally. Present term-permit contracts will continue until the close of their period. The new policy will not operate to the detriment of present term-permit holders. New grazing regulations will be issued this fall.

Market Conditions and Fees.—Despite a late decline in prices, market conditions averaged better than for 1936. Grazing fees for 1938, based on 1937 market prices, were increased an average of 2.43 cents per head per month for cattle; 0.58 cent for sheep.

Permits and Numbers of Stock.—In the calendar year 1937 there were grazed under 19,497 pay permits 1,254,425 cattle, 29,499 horses, and 241 swine; under 5,652 sheep permits, 5,477,351 sheep and 7,603 goats. Cattle permittees decreased 3 percent from 1936, sheep permittees 3 percent; the number of cattle grazed under pay permits decreased 2 percent, sheep 3 percent. In addition, 29,833 cattle, 41,821 horses, 11,067 sheep, and 1,039 goats were permitted under regulation authorizing free grazing of not to exceed 10 head of stock for any one person. During 1937, 53 percent of the cattle and 58 percent of the sheep in the national forests of the 6 western regions were grazed under term permits that began in 1936.

Reductions, Trespass, Losses.—Reductions in 1937 for range protection totaled 10,749 cattle and horses and 38,009 sheep and goats. Reductions for distribution totaled 551 cattle and horses and 3,404 sheep and goats. There were 20,682 cattle, 33,414 sheep, and 3,621 wild horses in trespass for varying periods in 1937. Livestock losses totaled

16,111 cattle and 161,770 sheep. Poisonous plants and predators were major causes of these losses.

Rodent Control.—To help save forage, rodent control, principally under cooperative direction by the Bureau of Biological Survey, covered 749,162 acres. The national-forest area treated to date is 13,845,761 acres; areas still infested total 13,529,188 acres.

Range Surveys.—During the calendar year 1937 some 5,852,000 national-forest acres were covered by intensive range surveys. The net total to date is 52,943,818 acres, plus 21,086,403 acres covered by less intensive surveys. Public agencies other than the Forest Service also make range surveys. Of the 728 million acres in all western range, nearly one-fourth had been covered by 1937. In that year a cooperative project between the several agencies was initiated for coordinating survey methods and jointly assembling and interpreting the data. During the year data for nearly 55 million acres were assembled on uniform maps, and plans were prepared to maintain range productivity and improve management.

Local Livestock Associations.—Those cooperating with the Forest Service during the year numbered 743. Of these, 719 had qualified for recognition under advisory board regulations. Field officers report that only 73 more local associations are needed to cover all national-forest grazing allotments.

Range Research.—Range research has added immeasurably to methods for improving range-forage conditions. Increased grazing capacity obtained on demonstration areas has stimulated reseeding by ranchers and stockmen. Experiments indicate reasonable success may be expected at moderate costs when: (1) Areas having average or better soil and moisture conditions are chosen; (2) seed of species already proven successful is sown; (3) seed is so sown as to be covered with soil; and (4) grazing is adequately controlled. The sagebrush-bunch grass zone can probably best provide forage when grazed on a rotation system that assures vigorous green feed during spring lambing period, and adequate fall feed during the breeding season. Experiments in southern Arizona show that good range management pays. A cooperating stockman on the Santa Rita Experimental Range made 8 percent on his investment during an 11-year period by applying sound range-management principles that brought greater earnings than rule-of-thumb management.

Range Management.—Range management has always occupied a prominent place in the work of the Forest Service. It is fair to say that, despite such things as overstocking during the war, and protracted droughts, most national-forest ranges are in better condition than others of comparable size. There is, however, real need for improvement; a need it has not seemed possible to meet because of ever-increasing demands upon fieldmen for planning and supervising such things as work-relief programs, increased use of timber, needs for

recreational facilities, and solution of wildlife problems. Demands like these have resulted in less range management on the ground. Efforts will be continued to carefully plan the time of forest officers, but the present administrative force cannot properly carry the increasing work load. Additional funds are needed.

WILDLIFE

Hunting and fishing have always been part and parcel of life in North America. Game populations receded alarmingly with settlement and reached an all-time low about the beginning of the present century. Nearly 75 percent of the big game in Western States now depends on national-forest forage in summer. Wildlife in all national forests includes about 1,700,000 big-game animals; some 1,800,000 fur bearers; game birds like the grouse and turkey; fish in about 70,000 miles of streams and in hundreds of thousands of lakes and ponds. From inspirational and practical viewpoints wildlife is a precious national forest resource.

Basic Conditions.—While on national forests, big game depend for food on the forage there. So do many domestic livestock. This has led to misunderstandings. These, in turn, have provoked expressions of opinion by some sincere wildlife enthusiasts to the effect that all domestic stock should be excluded from all national forests. Yet on the whole this opinion is not justified, for basic facts and conditions indicate that:

1. Except for stock such as is used by tourists, only about 60 percent of all federally owned national-forest land in the continental United States is used by domestic livestock. In round numbers this includes 91,000,000 acres.

2. With the exception noted 40 percent, or about 62,000,000 acres, is, insofar as it is adaptable, for exclusive use by big game.

3. Big game also use much of the 91,000,000 acres grazed by domestic livestock. This is partly because of the marked differences in food habits of domestic animals and certain species of big game; in part because of regulated stocking and conservative use of national-forest ranges by domestic livestock.

4. Despite a decrease of wildlife generally, the use of national-forest ranges by domestic livestock, and open hunting seasons, big-game populations on the national-forest system have increased about 150 percent since 1924.

5. With more winter range, wider distribution, and better management, there is room on most national forests for a much larger big-game population than now exists there.

Basic Problems.—Big-game summer ranges in most western national forests greatly overbalance winter ranges. Indeed, in most cases winter range is so scarce that it, more than any other one factor,

limits local populations of big-game species like deer and elk. Since in the West most winter range suitable for big game is now in private ownership, the solution of this problem appears to depend in large measure on greater dedication of private lands to wildlife, or land acquisition by public agencies to improve wildlife conditions.

Current problems of distribution center to a large extent around overpopulations of big game, and concentration on early-spring, late-fall, and winter ranges during seasonal migrations. About 20 problem areas of this sort have developed within national forests recently. The most conspicuous concern deer on the Kaibab National Forest, in northern Arizona; elk on the Gallatin and Lewis and Clark National Forests, in Montana; deer and elk on the Gunnison game refuge, in Colorado; deer on the Murderer's Creek drainage, in Oregon; and elk on parts of the Sitgreaves National Forest, in Arizona. Some of these problem areas have developed out of natural increases from stock transplanted years ago, and the situation has been aggravated because State laws have not permitted adequate management in time to avert present conditions. These problems can be solved by wildlife management.

Wildlife Management.—Good business dictates that forage on national forests be so maintained and used that wildlife and domestic stock may both contribute in the highest measure to the social and economic welfare of families, communities, and States. Ordinary business prudence dictates that no herd of domestic stock shall be permitted to increase beyond the supply of feed available to carry it; that man should make orderly herd reductions rather than permit indeterminate and indiscriminate losses by starvation, for example. The same principle applies to big game. It can no longer shift for itself; it must now have human help and guidance. In this, control of numbers is essential and far more humane than vicarious control by starvation.

Cooperation.—Increases in the big-game population on the national forests have in large measure been made possible by friendly cooperation. In this, sportsmen's clubs and other public and private agencies have helped, but State game departments, commissioners, and game laws and regulations afford the most effective media for cooperative wildlife management. Cooperative agreements with States have now been perfected or are in process of negotiation in all States within which there are appreciable national-forest areas. To accomplish this, enabling legislation has been necessary in many cases. In certain Eastern States, where lands in Federal and private ownership are intermingled, many recent agreements are, in effect, management programs and action plans.

The C. C. C. has helped protect and develop national-forest wildlife resources. It has surveyed, mapped, posted, and sometimes fenced game refuges; made game counts and surveys; studied game habits

and food plants; planted food shrubs; built fish hatcheries and rearing ponds; planted fish fry; done stream-improvement work.

RECREATION

Stresses of modern life have increased manyfold over what they were. Human beings need escape now and then to a more primitive world geared to a slower speed. They need recreation, which is no longer a luxury—recreation in the form of that peace, beauty, and adventure that forests are peculiarly fitted to supply.

National forests help supply recreational and inspirational values that in themselves help underwrite a better and a more permanent civilization. During 1938 more than 30 million visits to national forests were made by sightseers, campers, picnickers, resort and summer-home visitors, hunters, fishermen, hikers, horseback riders, mountain climbers, winter-sports enthusiasts, and others. Excluding sightseers and those simply passing through, approximately 14½ million of these visits were by people who stopped on the national forests for recreation. Each of these visits does not represent a separate person, for many people came frequently. It is, however, fair to say that millions of different people benefited from national-forest recreation; and millions more, merely driving around, enjoyed the cool freshness of mountain air and the beauty of the scenery.

Public Campgrounds.—Many national-forest visitors stop at hotels, summer resorts, and dude ranches. Others go to summer homes built under (p. 41) special-use permits. People with inclination and time pierce one or more of the 30 national-forest primitive areas that embrace about 17 million acres. But most national-forest visitors head for free campgrounds equipped with fireplaces, pure water, and simple but sanitary conveniences. There are now more than 3,500 of these developed campgrounds in the national-forest system. Most of them, and literally thousands of others not yet developed, may be reached by automobile. The C. C. C. has been a big factor in developing campgrounds, and roads and trails leading to and from them.

Facilities for Lower-Income Groups.—National figures show that nearly half of all families and independent individuals in the United States have an annual income of $1,000 or less. There is real need for simple but healthful recreation among this group; yet a survey made last year indicates that from this group came only 18 percent of the 2¼ million actual users of national-forest campgrounds.

The Forest Service feels that the national forests should be made more readily available to people in the lower half of the income scale. To do this certain things are necessary. Since among the lower-income group the cost of reaching free national-forest campgrounds and of stopping there is too great, the Forest Service is constructing organization camps where groups of people can take care of themselves

at minimum cost. Such camps will be made available to groups sponsored by welfare organizations and to groups and organizations such as farm and labor unions, Boy Scouts, Girl Scouts, Camp Fire Girls, and 4–H Clubs.

This is not a new or an untried idea. Comparable camps have for years been operated on national forests by municipalities, for example, and experience has indicated that with strict economy it may be possible (without interest) to amortize investments, pay for maintenance and management, and provide food, at a cost of about $5.50 per week per person. This does not include the cost of such recreational leadership as might be provided by the National Youth Administration. Transportation, often beyond the reach of many people in lower-income brackets, can be provided by civic and other welfare organizations.

On national forests the construction of camps for low-income groups is given high priority. Many suitable locations are selected and reserved pending availability of funds for construction by the Forest Service or municipalities or organizations.

Income From Recreation.—Income derived from it is a major consideration in evaluating the importance of forest recreation. Many villages, towns, and counties in forested country receive their major income from this source. Thousands of farmers and businessmen in many forest regions have their markets and activities tremendously expanded through purchases made by recreational visitors. Thousands of local people add to their incomes by renting rooms or cabins. Many towns and counties find a chief tax source in summer homes and resorts. Estimates indicate that at least 250 million dollars are spent annually in communities on or adjacent to national forests as a result of recreation.

Zoning for Beauty.—To preserve natural beauty and charm, the Forest Service has zoned many roads, trails, larger streams, lake shores, and major recreational areas. Depending on the topography, cover, and kind and degree of use, these zones vary in depth from 200 feet to half a mile. Their purpose is to preserve the natural forest environment for the enjoyment and inspiration of national-forest visitors. Within these zones such uses as cutting timber, grazing livestock, or establishing commercial enterprises are prohibited.

Appropriations, Expenditures, Auditing

Forest Service responsibilities and activities extend beyond the national forests. So do funds allotted to and expended by it. For the fiscal year 1938 they include, for example: From research appropriations, $2,017,086; from appropriations for cooperation with

States in fire control and planting, $1,674,180; from appropriations or services contributed by States, counties, associations, and individuals for fire control, slash disposal, improvement work, etc., $2,894,517; from appropriations for work relief including C. C. C. expenditures for camps on State and private lands, for camps located on lands controlled by other government agencies, and for national forest camps, $43,790,653; from appropriations of other government agencies, $621,573; and $668,664 for miscellaneous appropriations including repayments of deposits. Appropriations for protection, management, development, and extension of national forests were $32,732,549. This included, in part, $8,684,701 for forest highways (expended by Bureau of Public Roads); $6,574,311 for acquisition of additional forest lands from regular and emergency appropriations combined.

Expenditures to carry on Forest Service activities during the fiscal year were derived from 31 appropriations, and were grouped in six broad classes. Break-down of Forest Service expenditures and receipts, and expenditures by sources, are included in (p. 55) Section Z, Administrative Statistics.

To insure use in conformity with purposes for which they are appropriated, funds are allotted to units and subunits by appropriation objects or purposes; each unit or subunit maintains accurate records by funds and by projects, purposes, and objects; encumbrances and expenditures are confined to amounts and purposes authorized; administrative controls and detailed budget and accounting records are maintained. Strict control eliminates the possibility of funds being expended for other than authorized uses. Administrative control and thorough and independent auditing extend from the Washington office to the 10 regional offices, 12 experiment stations, Forest Products Laboratory, Prairie States project, 146 forest offices, 765 ranger districts, 38 State C. C. C. offices, and numerous C. C. C. camps.

Not only are there accounting and fund control records, but expenditures are broken down, without reference to appropriations into 56 major cost-accounting captions. These reflect the actual use of appropriated funds in connection with individual resources. They, and cost records kept by projects, supply the cost data used in administration and the data required by the Secretary, the Bureau of the Budget, Congress, and other agencies.

Total expenditures for all purposes by the Forest Service during the fiscal year were $84,399,222. Receipts were $4,671,133. Of this, $1,178,883 was, under existing legislation, returned to the States.

New Legislation

THE year's forestry legislation among States has been compiled by individual States and may be requested from the Forest Service, Washington, D. C. The following acts affecting the Forest Service were enacted during the third session of the Seventy-fifth Congress:

APPROPRIATION ACTS

First deficiency, act of March 5, 1938 (Public, No. 440), includes $1,279,417 for emergency fire fighting, fiscal year 1938.

Civilian Conservation Corps, act of April 25, 1938 (Public Resolution No. 88), appropriates $22,000,000 for fiscal year 1939 and reappropriates all unobligated balances from fiscal year 1938.

Independent Offices Appropriation Act, act of May 23, 1938 (Public, No. 534), appropriates $226,331,000 for the C. C. C., fiscal year 1939.

War Department Civil Appropriation Act, act of June 11, 1938 (Public, No. 591), includes $82,000,000 for flood-control work in fiscal year 1939, with $7,000,000 for the Department of Agriculture.

Department of Agriculture, act of June 16, 1938 (Public, No. 644), makes regular appropriations for fiscal year 1939.

Emergency relief, act of June 21, 1938 (Public Resolution No. 122), carries $1,712,905,000 for July 1, 1938–February 28, 1939, with $4,142,857 project funds and $207,143 administrative funds for the Forest Service.

Second deficiency, act of June 25, 1938 (Public, No. 723), includes $1,000,000 for repairing flood damage on national forests in California.

OTHER ACTS

Act of February 12, 1938 (Public, No. 428), authorizes purchase of lands for addition to Tahoe National Forest, in California and Nevada.

Act of May 11, 1938 (Public, No. 505), provides for acquisition of lands from receipts of Cache National Forest, Utah.

Act of May 26, 1938 (Public, No. 546), provides for additions to the Kaniksu National Forest, Wash.

Act of May 31, 1938 (Public, No. 559), provides for withdrawal from mineral entry of certain lands within Cleveland National Forest, Calif.

Act of June 15, 1938 (Public, No. 615), provides for additions to Black Hills National Forest, S. Dak. and Wyo.

Act of June 15, 1938 (Public, No. 624), provides for additions to Ochoco National Forest, Oreg.

Act of June 15, 1938 (Public, No. 629), relates to duties of Mount Rushmore Memorial Commission, South Dakota.

Act of June 15, 1938 (Public, No. 634), provides for the purchase of lands from receipts of San Bernardino National Forest, Calif.

Act of June 20, 1938 (Public, No. 679), provides for additions to Rio Grande National Forest, Colo.

Act of June 20, 1938 (Public, No. 683), provides for additions to Trinity National Forest, Calif.

Act of June 22, 1938 (Public, No. 692), provides for additions to Shasta National Forest, Calif.

Act of June 22, 1938 (Public, No. 693), provides for additions to Klamath National Forest, Calif.

Act of June 22, 1938 (Public, No. 694), provides for additions to Plumas National Forest, Calif.

Act of June 25, 1938 (Public, No. 748), authorizes purchase of lands from receipts of the Nevada and Toiyabe National Forests, Nev.

Act of June 29, 1938 (Public, No. 778), provides for establishing the Olympic National Park, Wash.

Senate Concurrent Resolution 31, adopted June 13, 1938, creates a joint Congressional committee to study the forest situation in the United States.

Administrative Statistics

THE Forest Service has for years compiled basic statistical material for administrative use and certain other purposes. In tabular form some of it has for years been included in the annual report, but much of it has not. To make more of it more readily accessible, this material is now assembled under the heading Administrative Statistics.

Section Z, Administrative Statistics, contains tables comparable to those included in last year's annual report, plus certain others. Key figures from these tables are incorporated in the text of the current report. If details are desired they may be obtained by writing for a copy of Section Z, Administrative Statistics. Requests should be addressed to the Forest Service, Washington, D. C.

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ANNUAL REPORT OF

DIRECTOR OF INFORMATION
Separate binder

REPORT OF THE CHIEF OF THE BUREAU OF HOME ECONOMICS, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF HOME ECONOMICS,
Washington, D. C., September 1, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith the report of the Bureau of Home Economics for the fiscal year ended June 30, 1938.

LOUISE STANLEY, *Chief.*

CONTENTS

	Page
Introduction	1
Economic studies	2
Incomes	2
Consumption patterns	5
Foods and nutrition	8
Nutritive needs of man	8
Food composition	9
Utilization of food	10
Textile and clothing research	10
Terry towels	11
Sheeting	11
Broadcloth	12
Upholstery fabrics	13
Blankets	13
Clothing sizes	14
Housing and household equipment	15
Publications and information services	16

INTRODUCTION

The need for conserving the Nation's agricultural resources of soil, forests, and other national wealth is being recognized, and work toward this end has become increasingly important in this Department. But the Nation's resources are not limited to such things as land, trees, and minerals; they include its people, and any comprehensive conservation program must take into account the safeguarding and development of human beings. No one governmental or other social agency can do this alone. As its share in this large undertaking, agriculture helps to promote better levels of living for the Nation's families. It has fostered the production of plentiful supplies of food and of fiber. The Department's broad policies of land utilization are based upon the well-being of the whole population, not upon increased returns to farmers alone.

The Bureau of Home Economics has a unique responsibility in the Department's efforts toward conservation and development of human resources. It alone, of the several bureaus, focuses its entire program of research upon the achievement of this end. It strives to determine human needs for food, clothing, housing, and the many other goods and services that are part of our national standard of living. It endeavors to find how to use the Nation's resources most effectively in meeting these needs and in increasing human satisfaction.

Thus in working toward conservation of human values, the Bureau also serves as a link between the producer, both in agriculture and industry, and the consumer. The science of production depends for its ultimate efficacy upon the development of the science and the art of consumption. And the only measuring stick for the success of both production and consumption is their contribution to human values.

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ECONOMIC STUDIES

Important to both agricultural and general welfare and fundamental to a sound agricultural program is an understanding of the kind and quality of living obtained by the Nation's families. Such knowledge helps to measure what the Nation has achieved, whether the actual levels of living of families are in accord with what we would be willing to accept as an American standard. It also helps to determine what are our production requirements if good national standards are to be reached and maintained.

A long step forward in obtaining some of the basic facts needed for a picture of levels of living of city, village, and farm families has been taken by the study of consumer purchases. This is an investigation of the expenditures and purchases of American-born families at different income levels. In this study, conducted by the Departments of Agriculture and Labor with the cooperation of the National Resources Committee, the Central Statistical Board, and the Works Progress Administration, the Economics Division of this Bureau is responsible for the work in 66 farm counties, 140 villages, and 19 small cities.

INCOMES

Family income may be considered a rough index of potential family well-being because of its close relationship to consumption patterns and to leisure for the enrichment of life. Analyses now in progress from this large-scale study show that in 1935–36 income levels of native-white families in small cities usually were higher than those of similar families living in villages and on farms. But family-income differences among geographic regions in the United States and even among communities of the same type (as cities) within a given region may be more marked than any consistent differences between city and farm, or between farm and village.

In computing the net income of farm and village families, nonmoney income in the form of home-grown food for family use, value of occupancy of owned home, and rent received as pay for services rendered, were included, as well as net money income from operating the farm or other business undertakings, from wages, and from other sources. For city families, value of home-produced food was not included in income.

By thus combining the value of farm-furnished products with money income, as a measure of total income, it was found that the families of farm operators studied in the Middle Atlantic and north-central region, and in the Pacific coast region, tended to have higher incomes in 1935–36 than did the village families in these regions. On the other hand, incomes tended to be higher among village families than among farm-operators' families in New England, and in the Plains and Mountain region of the West, where farm incomes in that year were unusually low because of the severe drought.

Median incomes rather than average incomes are used in this comparison since they present a better picture of the situation. One millionaire family might bring up a community average considerably; whereas there is no question as to the general economic situation when it is known that half the families fall above or below a certain income line.

Income figures represent only white families that included a husband and wife, both native-born, except in the Southeast where a special study of Negro families was made. The farm study was confined to families of farm operators; a special study of sharecroppers is reported separately. An operator's family must have lived for a year on the farm it was operating in order to have its income represent typical returns from farming. These restrictions tended to eliminate some of the low-income groups and thus to present a somewhat more optimistic income picture than would be given by all families in a community. In addition, the areas chosen as well adapted to a specific type of farming, as cotton or wheat, often were not typical of the State as a whole, being better farm land. Returns from these areas, therefore, were somewhat higher than the average for all farm land.

INCOMES OF VILLAGE FAMILIES

The 140 villages selected as representative of such communities throughout the country were grouped into 10 units for analysis. In five of these, median incomes of native-white families (relief and nonrelief) were above $1,100 and in the other five, below.

The median income of the native-white, village, unbroken families in the New England region (Vermont and Massachusetts) was $1,232. In villages of the Middle Atlantic and north-central region, median incomes of similar groups of families were: Pennsylvania and Ohio, $1,039; Michigan and Wisconsin, $1,086; Illinois and Iowa, $737. Corresponding figures for villages in the Plains and Mountain region were: Kansas and North Dakota, $916; Colorado, Montana, and South Dakota, $1,285. The Pacific region showed median incomes of $1,023 for Oregon and Washington, and $1,355 for California villages. In the southeast region, median incomes of white village families were: Georgia and South Carolina, $1,125; North Carolina and Mississippi, $1,548. Median incomes of Negro families were $316 and $373, in the same groups of villages.

Although white families in North Carolina and Mississippi villages tended to have higher incomes than those in other villages studied, this fact should not be taken as an indication of greater prosperity there than elsewhere. If in all regions median incomes had been computed for white and Negro families combined, it is probable that the medians for villages in the Southeast would have been no higher than in other regions, since Negro families comprise a large proportion of the low-income population in the Southeast.

INCOMES OF FAMILIES IN SMALL CITIES

In 10 of the 19 small cities studied by the Bureau, the median income of the native-white, unbroken families was below $1,250 a year. For two cities of industrial New England the median income of such families was $1,347; half the families getting more, half less. For seven north-central cities the median income was $1,164; for five Plains and Mountain cities, $1,420; for four Pacific Northwest cities, $1,555; and for two southeastern cities, $1,252. For native Negro families in these two southeastern cties, the median income was $419.

Families in which more than one worker pooled earnings to manage the group expenses ranged from a 9-percent low in Boone, Iowa, to 48 percent in Griffin, Ga. Many hands at work did not necessarily mean a greatly increased family income, as may be seen by comparing the median income of Boone, $1,154, with that of Griffin, $1,186.

FARM-FAMILY INCOMES

In none of the 23 farm sections chosen to represent production of the country's principal agricultural products, did more than half of the families of native-white farm operators have net yearly incomes, including both cash and kind, of more than $1,587.

Among 543 such families in 2 Vermont counties, the median income was $1,142. In 18 counties in 7 Middle Atlantic and North Central States—New Jersey, Pennsylvania, Ohio, Michigan, Wisconsin, Illinois, and Iowa—the highest median income, $1,503, was found for families in Illinois. The lowest median income in this group of States, $936, was that for families of Iowa, which was hard hit by bad crop conditions.

The ravages of the drought in 1935–36 were plainly discernible in the incomes of farm families of the Plains and Mountain region, where three separate areas were studied. Families farming North Dakota wheatlands stood at the foot of the regional list with a median income of $593. Kansas farm families in wheat counties and the families in range livestock counties in Colorado, Montana, and South Dakota were neck and neck with median incomes of $732 and $731, respectively.

On the Pacific coast the lowest median income, $1,039, was reported for Washington farm families. The highest median income, $1,475, was found in two counties in southern California, where the chief products were fruit and nuts.

Sharpest contrasts emerged, however, not from comparisons of geographic regions but from comparisons between sharecroppers and operators, and white and Negro families in the southeast region. The situations arising out of the system of tenure in the Southeast are so different from those elsewhere that no legitimate comparison can be made between the statistics for any single color or tenure group of this region and those of other regions.

The median incomes of the families of white operators in the southeast region ranged from a low of $611 for families in the self-sufficing farm counties of western North Carolina to a high of $1,587 for the families in tobacco counties of eastern North Carolina.

The median incomes of the families of Negro operators ranked ahead of the median incomes of families of white sharecroppers in three of the four States studied; in the fourth, Georgia, the median income of the families of Negro operators was $490 as compared with $544 for the families of white sharecroppers. The median incomes for families of Negro sharecroppers ranked at the bottom of the list in every State.

Cash income of farm families.—Statistics on the net cash income of farm families are peculiarly relevant to present-day socioeconomic problems. It is the cash income that links the farm family to the economic system as a consumer of industrial products. In New England, average net cash income for the group of nonrelief farm-operators' families studied was $789 for the year 1935–36. In the central region it ranged from a low of $581 for Iowa farm families to $1,202 for Illinois farm families. The drought is again evident in the figures for the Plains and Mountain region where the lowest average net cash income was $207 for the group in North Dakota and the highest was $874 in Colorado, Montana, and South Dakota. Cash incomes of Pacific coast farm-operators' families stood high among those for the five regions; the average of $1,623 for 1,115 southern California farm families was at the top; that for 1,621 Oregon full-time farm operators' families, $823, was in the upper one-half.

In the Southeast, families of white farm operators in Georgia fared worst with an average net cash income of $449 for the year, and those in Mississippi fared best with an average of $1,566 for 1935–36. The families of Negro farm operators had average yearly net cash incomes that ranged from $230 to $659, with Georgia low and North Carolina high.

Average yearly net cash incomes for the families of white sharecroppers ranged from $203 for Georgia to $643 for North Carolina. Somewhat lower on the scale, the families of Negro sharecroppers had net cash incomes that varied from a low of $175 in Georgia to a high of $523 in North Carolina.

Although the greater part of the net cash income of farm families came from farm operation, receipts from nonfarm earnings, investments, and other sources averaged 25 percent or more of the aggregate net cash income in 11 of the 20 groups of white operators studied. These average nonfarm money receipts of native-white nonrelief families of farm operators were: In Vermont, $186; in the Middle Atlantic and north-central region, a low of $70 in Iowa and a high of $330 in New Jersey; in the Plains and Mountain region, a low of $61 in North Dakota and a high of $138 in the range livestock sections of Colorado, Montana, and South Dakota; on the Pacific coast, a range of $256 in Oregon to $678 in southern California; in the Southeast, $127 in Georgia to $307 in western North Carolina where self-sufficing farms are prevalent and provide an average of only $87 net cash farm income. Sharecroppers, both white and Negro, reported an average of less than $50 per family net cash nonfarm receipts. A group of families near Portland, Oreg., included in a special study of part-time farming had nonfarm money income averaging $1,373.

Nonmoney income of farm families.—Farm families ordinarily aim for large money incomes, since they live in a money economy. However, nonmoney farm income was a factor of importance in every budget. The nonmoney farm income consisted of the value of their housing, food, fuel, ice, and other products furnished by the farm for family use, plus (or minus) the value of increases (or decreases) in crops stored for sale and of livestock. Of the average $554 per family nonmoney income in Vermont, for example, $510 was from farm-furnished housing, food, and other products, and $44 from the increase in livestock and crops stored for sale.

This nonmoney income furnished by the farm for family living acquires an added significance from the fact that averages varied less than those for other kinds of income received by families of farm operators in the different sections studied. If the budgets of these farm families had any anchor to windward against economic storms, it was the certainty of some income of this type. Over the entire country the average value of farm-furnished goods received by the families of white farm operators varied between $668 in North Carolina and $321 in southern California.

From the average values of farm-produced food for family use it becomes clear that on the lowest threshhold of farm-family subsistence it is the kitchen, garden, and the barnyard that save the day. The lower the average yearly income, the more important did supplies from these sources become. Excepting the southeast region and California, the range of the average value of such food was from $201 in Michigan to $367 in Iowa. In the southeast region, the range for families

of white operators was from an average of $361 in Mississippi to $525 in North Carolina. Averages for families of Negro operators and of white and Negro sharecroppers ranged between approximately $100 and $350.

These figures for value of home-produced food are based on prices the farm families would have paid had they bought food of the same quality, in similar quantities, from neighbors, or other nearby sources. Such prices are between retail and wholesale prices and thus give somewhat higher total-value figures than are customarily obtained by using prices received by farmers in wholesale markets where they sell other farm products.

CONSUMPTION PATTERNS

INCREASES IN FAMILY NET WORTH

A family's program of production for home use, its ways of spending money income, and the provision it makes for the future reflect its ideas of the kind of living the members consider most worth-while.

How much of its income a family uses for current living and how much for getting ahead financially is of especial interest in considerations of social policies relating to land tenure and to old-age security. Good money management alone does not always enable a family to balance its accounts or to save in any given year. There must be a certain minimum income, enough to stretch over its most urgent needs. While this minimum differs from family to family, depending on the number and age of its members, the size of community, and the region in which it lives, there are nevertheless fairly well-defined income limits within which families seem to be able to get ahead financially.

Of approximately 8,500 white families studied in 140 villages, the majority of those with incomes less than $1,000 reported no change or a decrease in net worth, while the majority of those with incomes of $1,000 or more reported financial gains during the year 1935–36.

The lowest income class in which white village families showed gains in net worth was $1,000 to $1,249, in the Middle Atlantic and north-central region. This dividing line was found in the $1,250 to $1,499 class in the Pacific and southeast regions; in the $1,500 to $1,749 class in the Plains and Mountain region; and in the $1,750 to $1,999 class in New England.

Among farm families average gains in net worth were found in the $1,000 to $1,249 income class (money and nonmoney income) in the areas studied in Pennsylvania and Ohio; in the income class $1,250 to $1,490 in Illinois and Iowa and in Kansas and North Dakota; and in the $1,500 to $1,749 income class in California. Families at the very lowest income levels decreased their assets or increased their liabilities to obtain the meager amount for the minimum necessary for their living. But at a fairly low level—when the net money income fell between $500 and $1,000—a large number of families begin to depart from a mere balancing of living expenditures with income and to apply part of their funds to paying off obligations or increasing assets. Payments on the principal of the farm mortgage and on life insurance, increased bank accounts, and investments in the farm business were quite generally the largest items in all the regions.

The increase in net worth of farm families was proportionally larger at every income level than among village or city families. Pennsylvania and Ohio farm families with net incomes of $3,000 or more increased their net worth by an average of $1,449, or about 43 percent of their average income, and used only a little over half for current living. In small cities in the north-central region, families at this income level spent an average of $2,450, or about 72 percent of their money and non-money income, for family living, and devoted only an average of $747 to getting ahead financially.

With increasing incomes, farm families apply the brake to accelerating expenditures for living far more than do city families. This tendency to an upper limit of the farm family's value of living has also been observed in previous studies and has been attributed to various causes, among them the competition between the family and the farm business (or other forms of investment) for the available income, fewer opportunities for increasing expenditures for cultural development, less tendency in the rural environment toward conspicuous consumption, and the essential democracy and lack of class distinction in a rural community. In 1935–36 the tendency towards limiting expenditures in order to pay debts may have been unusually pronounced because of debts accumulated during the depression, and in some localities because of drought.

The expenditure patterns prevailing in any community doubtless affect both the minimum spent for living, regardless of income, and the income levels where increasing net worth is preferred to spending. The data from a number of areas suggest that the point where a tendency towards an upper limit on average expenditures for living can be observed depends upon the income distribution in the community. Income distributions of Negro families are low, and both upper and lower levels of spending are below those of white families. The families of California citrus fruit growers, who had higher incomes than most of the other farm groups studied, devoted a much greater proportion of their income to family living than did families in other regions.

PATTERNS OF SPENDING FOR FAMILY LIVING

The most striking change that has taken place during the last generation in patterns of expenditures for family living is the prominence given to the automobile. Today's family must have its automobile, and when purchase of a new one is not feasible, a used car is bought to make life more livable.

In California, North Dakota, and Kansas cars were owned by 97 percent of the nonrelief native-white farm families studied. In Vermont, the percentage was 73—still almost three-fourths. Georgia and Mississippi showed 62 percent of the white farm operators having automobiles, the lowest percentage for any group of families of white operators studied.

Only in California were more new than used cars purchased by farm families. Used cars were bought about twice as often as new cars in six of the areas reported. In the east-central region, for each 1,000 families studied there were about 50 new cars and 125 used cars reported in the year's purchases. Most of the new cars bought ranged in gross price from $600 to $1,000. The average price of the used cars was usually well above $200. A few used cars costing $100 or less were bought, but usually only by low-income families.

Village families, too, have their cars. In the villages studied in the north-central region, expenditures for the family automobile were second only to food at the higher income levels. Families with incomes of $1,500 to $1,749 spent an average of $13 out of every $100 for the purchase and upkeep of automobiles. Of this amount, approximately $7 went for car upkeep, and the remainder for purchase of new or used cars. Eighty-four out of every hundred families at this income level were car owners. The averages are based on all families, however, regardless of whether they owned cars and had expense for car operation.

In contrast to these figures are those for villages in the Southeast. There, even in the higher-income groups the automobile usually accounts for a smaller outlay than does food, clothing, housing, or running the house. In many cases expense for medical care also exceeds that for the automobile. The two regions are similar, however, in the increasingly important place occupied by the automobile as income rises.

The automobile seems to be virtually the sole means of transportation for village families. Average annual expense for other travel and transportation was below $10 for nearly all groups, and in the majority of occupational and income classes was under an average of 50 cents a month.

The house of a city family often is taken as an index of its economic situation. This is less true in farm areas, where number of acres, fences, barns, and other evidences of prosperity are available. However, kind of housing does give some indication of levels of comfort achieved. Among the families of white operators in the $1,000 to $1,249 income class, the size of house—the average number of rooms—ranged from 5.5 in California to 9.5 in Vermont. The percentage of homes with hot and cold water in kitchen and bath ranged from 5 percent or less in the Southeast to 75 percent in California. The farmhouses on the west coast tended to be smaller than northern houses, but more of them were equipped with facilities making for comfortable living. Although the farm family may spend less than the city family for its housing, it may obtain less in the way of running water, electric lights, central heating, and other facilities that add to comfort and save labor.

In villages one-family houses predominate. Home owners outnumbered renters in half of the village groups studied. The percentage of white families that owned their homes varied from 38 in Georgia and South Carolina to 56 in Michigan and Wisconsin. Among the Negro families in the southeastern villages, about one out of every three occupied an owned home, a proportion smaller than among any group of white families.

As a general rule, home ownership in small cities was more frequent at income levels of $1,500 and more than in those below. As the income level rose, the amount spent for rent increased, though less rapidly. Two-family houses and apartments were more often found in northeastern industrial cities than in other regions. In agricultural marketing centers and in industrial cities in the Central West, the one-family house was the usual American home.

An adequate supply of suitable food is important for healthful living. A study of the diets of families of employed wage earners and low-salaried clerical workers in cities showed that from the standpoint of nutrition, diets stood in need of improvement in the case of 40 to 60 percent of the white families in four regions and in the case of more than 60 percent of the Negro families in the South. None of these families had been on relief during the previous year and all of them had had incomes of at least $500. These figures regarding city diets are corroborated by data concerning the diets of nonrelief families covered by the consumer purchases study. This study paints an even darker picture for village than for city families, but a much brighter one for farm families.

With the dietary habits and retail food prices current in 1935, the year in which the dietary study was made among wage earners, there was a level of food expenditures (different for each region) above which families were able to purchase adequate diets. About 10 percent of the diets classed as good were actually purchased by families for less than the following amounts per person per week:

White families living in—	
North Atlantic cities	$2.75
East North Central cities	2.70
East South Central cities	2.15
Pacific cities	2.60
Negro families living in southern cities	1.90

The expenditure levels below which 10 percent of the good diets were purchased may perhaps be taken as a reasonable yardstick of minimum cost of a good diet in the different regions. They cover, with a little leeway for some food groups, the cost of a fully adequate food budget. The proportion of families, region by region, spending as much as or more than the stated sums was white families living in the North Atlantic region, 51 percent; East North Central, 45; East South Central, 50; Pacific, 60; and Negro families living in the Southern region, 32. However, not all families spending enough to buy fully adequate diets succeeded in getting them. Of every 10 white families spending enough, only 2 to 4 selected good diets. Among Negro families in the South, the proportion was a little over 3 out of 10. These figures point to the need both for increased purchasing power on the part of urban groups, and for more widespread education in nutrition and in over-the-counter food buying in order to help them make the most of their money resources for food.

Families of moderately well-to-do city wage earners whose diets rated "good" from the standpoint of nutrition bought more eggs, from 50 to 100 percent more milk, and more than 50 percent more fruit and vegetables than the average for this population group. These foods are sometimes called "protective foods," because they are especially rich in certain nutrients of which a shortage is frequently encountered. But urban families often find them expensive to buy. Their purchases of just these items increase greatly when their purchasing power is improved. To supply these increased quantities of food—which city families would like to buy had they sufficient income—would mean greatly increased production on the part of farms.

The better-than-average diets enjoyed by farm families may be attributed in large part to their programs of food production for family use. The amount, kind, and value of farm-furnished food vary with the region and type of farming.

The average value of home-produced fruits and vegetables used by families of farm operators exceeded $75 in about one-half of the areas included in the consumer purchases study. Milk and cream furnished by the farm to the family had an even higher value; the average exceeded $100 in more than three-fifths of the areas. Families used enough poultry and eggs from the farm that in three-fifths of the areas the average value exceeded $50.

The value of food furnished by the farm for the family table might be expected to remain at a constant level, independent of the family income. However, this is not the case. It increased with income. Because of limitations of the family's capacity to consume, there is an upper limit to the value of home-produced food that can be used; but this is not reached until the income is relatively high.

Most farm families lack some of the freedom of choice enjoyed by the urban, whose income is largely in the form of cash. However, by looking ahead and

making a moderate outlay of cash, land, and labor, many can add to their money income an income "in kind" that contributes richly to a good table and to good health.

FOODS AND NUTRITION

The general well-being of the human race is determined in large measure by its food habits. To this extent, the use of a diet containing adequate amounts of all the food essentials is an important factor in health. A large share of many family budgets goes for food, and for this reason, too, it is important that food be so selected and prepared as to yield the highest possible returns in good nutrition at different cost levels.

NUTRITIVE NEEDS OF MAN

The current research program is centered on the nutritive needs of man. In considering these requirements, it is necessary to study all factors that influence the way the human body utilizes essential nutrients. For many years our requirements for food energy, protein, and the more important mineral elements have been recognized. Recently, a great deal of scientific interest has been directed to the physiological importance of the vitamins, and to studies that would ascertain how much of each vitamin the body needs daily.

A study of the adult requirement for vitamin A has therefore been inaugurated. In order to determine the vitamin A requirements of man, it is necessary to have a basis for distinguishing between nutritional states of adequacy and inadequacy of this vitamin. Of the several recognizable signs of vitamin A deficiency, it now seems that nutritional night blindness, or the inability to see well in dim light, is the earliest to appear. There are several instruments for testing the presence or absence of night blindness in human beings. A number of human subjects were tested and an instrument known as the visual "adaptometer" was found to be reliable and accurate in measuring small differences in sensitivity to dim light.

The adaptometer was then used in a detailed study of the vitamin A requirements of humans, in which five normal, well-nourished adults served as subjects. During the experiment, which lasted nearly 6 months, the subjects ate only food that was prepared and weighed in the laboratory kitchen. This diet was planned to provide an abundance of all the known nutritive essentials with the exception of vitamin A, which was present only in very limited amounts. The subjects were tested frequently with the adaptometer, and after intervals of time varying from 2 to 6 weeks they showed impaired dark adaptation. These individual differences are explained by the fact that each person had a different amount of vitamin A stored in his liver, depending in part on his diet previous to the beginning of the experiment.

When the dark adaptation had changed so that it was requiring 10 times as much light for the subject to see in dim light as when he was normal, vitamin A was added by giving biologically assayed cod-liver oil, which was carefully weighed into gelatin capsules. Small amounts were given daily at first and these were increased slowly until the dose of cod-liver oil was reached that would just return the dark adaptation to normal. As might be expected, the dose required was different for each individual; it varied from 1,300 International Units a day for the smallest to 3,900 for the largest. This figure included the small amount of vitamin A in the diet as well as that in the cod-liver oil. Even when the size of the person was taken into consideration, there was still a difference in the amount of vitamin A necessary for individuals. The minimum requirement varied between the limits of 25 and 56 International Units per kilogram of body weight.

Because in low-cost dietaries the main source of vitamin A is the carotene of leafy, green, and yellow vegetables, the study of human requirements was continued using carotene instead of cod-liver oil to provide adequate vitamin A. It was found that the amount of carotene required to restore normal vision in dim light varied from 43 to 103 International Units per kilogram of body weight. The carotene was only about 60 percent as efficient as vitamin A from fish-liver oil in providing for the vitamin A requirements of adults.

Even this efficiency of carotene will not be attained unless significant quantities of fat are present in the diet. Furthermore, the fats commonly used as food differ somewhat in their ability to promote the assimilation of this substance. For these reasons it is planned to investigate both the kinds and the

quantities of food fats that will bring about the best utilization of carotene. The properties of fats that may account for these nutritive differences are also being studied.

In recent years notable strides have been made in isolating and chemically identifying the different vitamins. However, the components of the vitamin B complex are still not clearly defined. A study now in progress deals with the fractionation of the vitamin B complex in rice polishings. It has resulted so far in establishing the means of preparing very potent concentrates of at least two unidentified vitamins in rice polishings. These concentrates have been found to be very effective in promoting growth in experimental animals and in preventing the development in them of a specific type of dermatosis. These concentrates, the most active of which are highly crystalline, are distinct from thiamin and riboflavin.

Consumers are constantly asking for information about the vitamin content of commercially canned foods, such as tomato juice. A study to compare the vitamin C content of commercially canned tomatoes and tomato juice showed both to be good sources of vitamin C (ascorbic acid), even though there was variation in ascorbic acid content from can to can of the same brand and from brand to brand. The samples of canned tomatoes varied less in ascorbic acid content than did the canned tomato juice.

Studies on the vitamin C content of home-canned tomatoes show that there was no loss of vitamin C under the processing methods used. Home-canned tomatoes stored for 6 months at ordinary room temperature suffered 30 to 50 percent loss of vitamin C.

Commercially canned tomato juice and fresh orange juice stored in the refrigerator below 45° F. for 2 to 3 days showed no appreciable loss of ascorbic acid.

Carrots and spinach (both raw and cooked) were assayed to determine losses in vitamin A and in vitamin B_1 (thiamin) due to the effects of heat and oxidative processes. The results indicate that, provided the vegetables are not overcooked, practically all of the vitamin B_1 value is retained in the cooked vegetable and cooking water. However, since appreciable quantities of thiamin are recovered in the cooking water, it is important that this juice be served along with the cooked vegetable.

Studies on vanadium, one of the trace elements, are being pursued in order to determine whether it is a necessary constituent of the diet. The results show that moderate quantities of vanadium in the diet of experimental animals (12 to 25 parts per million of the diet) are tolerated without any gross symptoms. Above 100 parts per million the vanadium is toxic, and with 400 parts per million many of the animals die.

The United States Public Health Service cooperated with the Bureau in studying the effects of these toxic doses of vanadium upon the various tissues. Outstanding was the finding of an acute inflammation in the intestinal tract, often accompanied by ulcers. Most of the animals showed hemorrhages in the lungs, destruction of liver tissue and bone marrow, and an abnormally small spleen, the blood content of which had been definitely decreased. The brain and cord often showed congestion in the early stages. As is the case with some toxic elements, there was no cumulative effect from feeding vanadium daily over a long period, provided the lethal dose was not exceeded at any one time. Spectrographic analyses are now in progress to determine the distribution of vanadium in animal tissues, as a step towards a better understanding of the physiological function of this element.

FOOD COMPOSITION

The preparation of tables on food composition for general use in calculating or planning diets or in evaluating foods is nearing completion. The list contains more than a thousand items for which protein, fat, carbohydrate, and caloric values will be given.

Summarized data on calcium, phosphorus, and iron in cabbage, lettuce, and spinach indicate that the very green leaves are the richer in calcium and iron. Green cabbage, either savoy or the green, nonheading varieties, is apparently the richest of these three vegetables in calcium, but spinach excels in total iron. These studies have considered only the total amount of calcium and iron present in the vegetables and have not taken account of any differences in the way the body utilizes these elements from different sources.

UTILIZATION OF FOOD

The quality of the family diet depends not only on the kinds of food that are selected but also on the ways in which foods are processed and prepared. To round out its program in foods and nutrition, the Bureau therefore studies the principles and methods of food preparation and preservation, and the effect of these different methods on food quality.

Studies previously reported showed that the diet of the hen, season of the year, and the period in the laying cycle have no effect on the leavening power of the egg whites in sponge-type cakes. Some market eggs are characterized by very thin whites. To test the value of these so-called watery whites as a leavening agent, the foams from whole normal whites, from mechanically separated thin whites, and from firm whites were compared. These were further tested in angel-food cakes, with the following tentative results: The cakes made from the thin egg whites were less soft and elastic, tougher, and had less volume than those made from the whole and the firm whites.

The influence of consistency of fat on its shortening value has been studied with lards, hydrogenated fats, compound, margarines, and butter in pastry squares and modified shortbread. Significant differences in breaking strength were found for some of the fats when the products are mixed at 22° C. Tests are now being made at other temperatures.

The study of meat quality has been continued in cooperation with the Bureaus of Animal Industry and Agricultural Economics, and several State agricultural experiment stations. About 450 cuts from experimental cattle, lambs, and hogs were cooked by standard methods and judged for palatability. The meat samples represent animals used in studies of such production factors as breed, sex, age, and feeding, and of various methods of curing, ripening, and storing the meat.

In the cooperative study of poultry quality 185 turkeys and 20 frozen chickens were cooked and judged for ration and storage experiments.

Tests were conducted in cooperation with the Bureau of Plant Industry to determine the relationship between the specific gravity of potato tubers and their mealiness when cooked. If the specific gravity is a sufficiently reliable index of mealiness, it is believed this method could be used in the studies for selection of varieties of high cooking quality, rather than the more involved cooking tests. The study of the effect of spacing and depth of planting of potatoes on the quality of cooked potatoes was continued for a second season. No significant relationship was found between excess potash in the soil and after-cooking blackening of potatoes.

As part of a varietal selection study of soybeans, also cooperative with the Bureau of Plant Industry, 68 varieties of green vegetable soybeans were cooked and judged for quality. Kura, Aoda, Higan, and Willoni tested for 4 successive years showed consistently good quality. Others showing good quality are Rokusun, Bansei, Hahto, and Shiro. The Hahto, Rokusun, and Aoda varieties had better eating quality when gathered at the prime stage. Hakkards and Jogun were equally good when preprime or prime, while the Kura beans were good at all three stages.

The investigational work in canning was confined to a study of adequate processing periods for meat. Of the 1,600 cans to be packed in No. 2 and No. 3 cans, the 1,035 finished have included parboiled beef, beef exhausted in the can, beef hamburger, parboiled pork loin, and pork sausage, all in No. 2 tin cans. For each kind of pack, part of the cans were inoculated with a putrefactive anaerobic bacterium, designated by some bacteriologists as type C *Clostridium botulinum*. The organism produces gas but no toxin. All cans were processed in a steam-pressure cooker at 250° F., for varying periods, and are being stored for 6 months at 95° to 98°.

TEXTILE AND CLOTHING RESEARCH

Realizing the great need of definitions as guides to buying and of "landmarks" by which consumers can judge values within a given class of fabrics, the Bureau is studying the fabrics on the market and suggesting minimum specifications for various classes of textiles and for different grades within each class. Data thus obtained on broadcloth, toweling, and sheeting were used this year by the American Society for Testing Materials in recommending tentative specifications for these fabrics.

TERRY TOWELS

Terry towels, articles bought by every household, vary tremendously in construction and, therefore, in the amount of service they give. Such articles bear no labels that give any information concerning relative values and even classifications are lacking that will inform consumers of the variation in the types they are buying. Bottom qualities are now suggested, below which such a fabric should not be called a terry towel—thus eliminating from the market qualities so poor as to be worthless as a towel. This definition is based on these specifications: Terry toweling shall be a cotton fabric covered with loops on both sides and requiring in its construction two sets of warp and one of filling yarns. The ground-warp yarns shall be either single or double ply; the number of yarns per inch shall be not less than 22 in the ground, 26 in the pile, and 26 in the filling; the breaking strength shall be not less than 18 pounds warpwise and 30 pounds fillingwise (strip method); and the weight shall be not less than 8 ounces per square yard.

Four types for which breaking-strength values are proposed, vary from 18 to 44 pounds in the warp. It is also recommended that the type be designated on towel labels and minimum specifications are proposed as to number of yarns per inch, weight, and breaking strength for each type so that the consumer will have definite facts on which to base her selections.

A serviceability study has been completed on four groups of towels representative of two of these constructions, namely, double-loop towels with single-ground warp yarns and single-loop with double-ply ground-warp yarns. With increasing service, the breaking and bursting strengths of all four qualities of towels decreased while the chemical deterioration as measured by fluidity in cuprammonium hydroxide, copper number, and methylene blue absorption increased. For each construction of towels the quality that originally showed more chemical deterioration continued to do so throughout service. Warpwise, the double-ply towels had a higher breaking strength after 100 washes than did the single-yarn towels when new. Throughout the study the double-ply towels were heavier and stronger than the single-yarn towels, and showed no excessive chemical damage. It was apparent that they would give greater satisfaction to the user than the single-yarn towels.

SHEETING

The names of even staple fabrics mean little today. For example, when the word "percale" was first applied to sheeting, it meant a very fine fabric of combed yarns with at least 100 warp yarns and 100 filling yarns per inch. In order to profit by the luxury appeal of this fine fabric, gradually coarser and coarser sheetings of cheaper carded yarns were put on the market under such names as "utility percale" or just "percale" and sold to unsuspecting consumers who associated the name with its original use.

As a result of its studies, the Bureau recommends that consumers recognize five distinct classes of sheets: Three weights of muslin (heavy, medium, and lightweight), percale, and a coarser sheet of approximately the same weight. The following definitions of each, based on minimum specifications are suggested: Grade A (heavy muslin), a fabric of carded yarns, with a minimum of 74 warp yarns and 66 filling yarns per inch, a minimum weight of 4.6 ounces per square yard, and a minimum breaking strength of 70 pounds; grade B, a mediumweight muslin, also a fabric of carded yarns with a minimum of 68 warp yarns per inch and 60 filling yarns per inch, a minimum weight of 4.2 ounces per square yard, and a minimum breaking strength of 60 pounds in the warp and 50 pounds in the filling; grade C, the coarsest (a lightweight muslin), a fabric of carded yarns with 56 yarns per inch both warpwise and fillingwise, a minimum weight of 3.9 ounces per square yard, and a tensile strength of 50 pounds in the warp and 45 pounds in the filling.

It is further recommended that the word "percale" be reserved for the sheeting of the finest yarns and highest yarn count—a fabric of combed yarns with a count of not less than 200 yarns to the inch (warp plus filling), a maximum weight per square yard of 4 ounces, and a minimum breaking strength of 60 pounds. The coarser fabrics of similar weight and somewhat lower breaking strength made of carded instead of combed yarns might well be given some other name so they will not be confused with percales. "Muscale" is suggested.

Additions were made to the knowledge of the serviceability of such materials by a study of sheetings made from two selected mill types of cotton. This study, in cooperation with the Bureau of Agricultural Economics, was made on heavy muslin sheetings manufactured from a cotton designated as A, which ranged from Middling Light Spotted to Strict Middling Spotted in grade and from 15/16 to 1 inch in staple length, and one designated as B, which ranged from Middling to Strict Middling in grade and from 31/32 to 1 1/16 inches in staple length.

All the physical and chemical tests measuring damage showed in general that the fabric made from cotton A was more deteriorated originally and throughout use than the material made from cotton B. Wear had more effect on the physical than on the chemical properties of the sheets. For example, after 250 washes, the physical values of the sides that received the minimum wear were similar to those of the center section after 200 launderings while the chemical values of the sides of the 250-wash sheets approximated those of the center after 225 times washed.

The length of service as measured in units of 1 night's use and of one laundering of the cotton-A heavy-muslin sheeting was 281 periods and cotton B, 276 periods. It is evident that the difference in the deterioration of the two cottons was not great enough to affect the serviceability of the resultant fabrics. When mediumweight muslin sheets were made from 1-inch staple cotton, the sheets made from cotton of Good Middling grade were serviceable for 237 periods and those from Middling cotton for 239 periods. The Bureau's studies made so far on sheeting show that the construction of the fabric affects serviceability more than does the grade of the cotton.

BROADCLOTH

Broadcloth is another fabric that has been lowered in quality until the word means nothing at the present time. An analysis of a great variety of fabrics sold as broadcloths discloses that constructions vary from those originally associated with the word to fabrics more like muslin than broadcloth. The following definition for cotton broadcloth is therefore proposed: It shall be a plain-woven, bleached, cotton fabric. The yarns shall be either carded or combed, and there shall be approximately twice as many warp as filling yarns per inch. The number of yarns per inch shall be not less than 100 warp and 54 filling; the breaking strength shall be not less than 56 pounds warpwise and 20 pounds fillingwise (grab method); and the weight shall be not less than 3.0 ounces nor greater than 4.0 ounces per square yard.

All the broadcloths on the market can be classified in four distinct types or classes. Consumer satisfaction with these fabrics would be increased if minimum specifications were set up for each of these and broadcloth fabrics and garments marketed on the basis of type. The specifications suggested are as follows:

Type 1 (low-count single broadcloth, carded, unmercerized). Minimum number of yarns per inch 100 warp and 54 filling, minimum weight 3.0 ounces per square yard, minimum breaking strength (grab method) 56 pounds warpwise and 20 pounds fillingwise.

Type 2 (high-count single broadcloth, carded or combed, usually mercerized). Minimum number of yarns per inch 132 warp and 58 filling, minimum weight 3.1 ounces per square yard, minimum breaking strength (grab method) 76 pounds warpwise and 24 pounds fillingwise.

Type 3 (mixed-ply, two-ply warp with single filling yarns, combed, and mercerized). Minimum number of yarns per inch 110 warp and 56 filling, minimum weight 3.0 ounces per square yard, minimum breaking strength (grab method) 90 pounds warpwise and 24 pounds fillingwise.

Type 4 (double-ply, two-ply yarns in both warp and filling, combed, and mercerized). Minimum number of yarns per inch 146 warp and 72 filling, minimum weight 3.1 ounces per square yard, minimum breaking strength (grab method) 90 pounds warpwise and 32 pounds fillingwise.

In this connection, a study is being made of 35 shirts, ranging in price from 69 cents to $5 and made of broadcloth, madras, chambray, oxford, covert, and jean. They are tested for weight, thickness, yarns per inch, breaking strength, shrinkage, and effect of abrasion. In the cheap broadcloth shirts so far analyzed, the material was the type here defined as type 1; medium-priced broadcloth shirtings corresponded to type 2; while those in the upper range

were of type-4 fabric. The material defined as type 3 frequently goes into uniforms, but seldom into business shirts.

The fillingwise breaking strength was used to rate the fabrics because worn shirts show that the filling yarns are the first to break in actual wear. Results of tests on the new shirts show that among these particular samples, oxford had the greatest fillingwise strength. Chambray, madras, and 2 by 2 broadcloth had about equal strengths. Type-2 and type-1 broadcloths were lowest, type 2 being stronger than type 1.

On the other hand, considering the percentage of change in breaking strength in the fillingwise direction after the material has been desized and abraded, oxford shows the greatest change, then chambray, and madras. All types of broadcloth show the least change.

UPHOLSTERY FABRICS

Upholstery fabrics are another class of textiles that, under present merchandising practices, with their lack of specifications or grading system, must be bought by guess. Oftentimes, moreover, these materials are already nailed to furniture frames so that the buyer cannot even examine the back of the fabric or gain the slight bit of information that ordinarily can be obtained by feeling the fabric or holding it up to the light. The initial high price of upholstered furniture and the cost of replacing worn-out coverings often make this a particular hardship to consumers.

As a basis for proposing minimum requirements for different types of upholstery fabrics, an analysis was made of 62 samples divided into five classes: Rib weaves, damasks and brocades, friezes, velvets, and novelties. Minimum requirements are recommended for two grades of each of the first three groups. These requirements cover the weight per square yard and the breaking strength, both warpwise and fillingwise, of the cloth before and after it had been abraded 10,000 rubs under 3 pounds pressure and 2 pounds tension. The number of tufts per square inch and the weight of pile per square yard were also included for the pile fabrics.

These proposed requirements for upholstery fabrics have recently been published and are being studied by the trade with great interest.

BLANKETS

With a view to suggesting guideposts helpful in buying blankets, various qualities offered in the retail market were studied and a classification suggested based on fiber content with minimum specifications for two classes of all-wool blankets and two of all-cotton, one for cotton warp-wool filling, and one for blankets containing between 5 and 25 percent of wool.

It is proposed that all-wool blankets have at least 24 yarns warpwise and 16 fillingwise. Lightweight all-wool blankets should weigh at least 8.4 ounces per square yard, have a minimum breaking strength (grab method) of 20 pounds warpwise and 12 fillingwise, a minimum thickness of 0.090 inch, and should not allow more than 180 cubic feet of air to pass through 1 square foot in 1 minute at a pressure difference of 1 pound. Heavyweight all-wool blankets should weigh at least 12 ounces per square yard, have a minimum breaking strength of 30 pounds warpwise and 20 pounds fillingwise (grab method), a minimum thickness of 0.120 inch, and should not allow more than 130 cubic feet of air to pass through 1 square foot of blanket in 1 minute at a pressure difference of 1 pound.

Blankets having a cotton warp and a wool filling should weight at least 9.4 ounces per square yard, have a yarn count of 30 warpwise and 28 fillingwise, a minimum breaking strength (grab method) of 30 pounds warp and 20 pounds filling, a minimum thickness of 0.090 inch, and a maximum air permeability of 130 cubic feet.

In cooperation with the Bureau of Animal Industry an investigation is being carried on of the use value of various qualities of American-grown wools. First a service study was made on blankets from different qualities of new wool and reworked wool, a new wool fabric of one-half-blood fineness that met the proposed requirements for heavyweight wool blankets was still in good condition after 52 periods of service. The blankets tested were used in a postoperative hospital ward and the number of launderings was considered as a measure of the amount of service. Another fabric of 1 part new three-

eights-blood wool and 2 parts reworked wool that met the proposed requirements for lightweight wool blankets was serviceable for 36 periods.

The work is being continued with heavyweight blankets made from good three-eighths-blood Idaho wool, combined with varying amounts of good and poor quality reworked wool. Blankets of each lot, of different composition, have been withdrawn after 12 periods of use and laundering, and the resultant deterioration is being measured by physical and chemical methods of analysis. These include such tests as those for heat transmission, air permeability, breaking strength, sulphur and nitrogen content, and fiber-scale breakage.

As part of the tests on the serviceability of blankets, a study is also being made in cooperation with the Bureau of Plant Industry, of the role of micro-organisms in the deterioration of such materials, and methods are being developed for sterilizing wool fabrics without damaging the fibers. Blankets, clothing, and other articles must be sterilized after contact with contagious diseases. Heretofore, any process that killed the micro-organisms did considerable damage to the material itself. New methods are needed.

The micro-organisms used in this work are *Bacillus mesentericus*, the spore-forming test organism, and the disease organisms *Staphylococcus aureus*, *Epidermophyton curis*, *Trichophyton interdigitale*, and *Mycobacterium tuberculosis*, which cause boils, ringworm, athlete's foot, and tuberculosis, respectively. The methods that have proved most successful are heating in xylene, Stoddard's solvent, or tetrachlorethylene. At present the effect of adding such chemicals as acetic acid and sodium chlororthophenylphenate to these solvents and of using formaldehyde gas alone is being investigated.

CLOTHING SIZES

Children's clothing and patterns are sized on a basis of age, but it is becoming more and more apparent that these age designations have little or no relationship to the dimensions of children. Garments bearing the same age markings, but coming from different manufacturers, rarely have the same dimensions, and most of them are too small for children of the age specified.

In order to provide the facts upon which better garment sizing may be based, the Bureau has undertaken the leadership in a cooperative study of the body measurements of children 4 to 14 years of age. This was made possible through the allotment of funds by the Works Progress Administration and through the cooperation of the National Youth Administration.

This project has been carried on in cooperation with the following institutions: University of Alabama, University of Iowa, Kansas State College, University of Minnesota, Pennsylvania State College, Agricultural and Mechanical College of Texas, Texas State College for Women, North Texas State Teachers College, Texas Technological College, Colorado State College, University of Colorado, University of California, Chicago Normal College, Detroit public schools, Cincinnati public schools, University of Tennessee, Utah State College, University of Utah, and the Omaha public schools. The Bureau has been in direct charge of the work in the District of Columbia and in Maryland.

The measurements taken are those of greatest importance in the construction of patterns and clothing, and number 36, including weight. Ninety thousand boys and girls from different economic levels have been measured to date.

Since experience seems to show that age is a very unsatisfactory basis for the sizing of garments and patterns, and it is neither necessary nor practical to size them on the basis of all the 36 measurements, an effort is being made to determine statistically from the data collected, which one measurement or combination of measurements will best serve this purpose. As a preliminary study, the search for such key measurements was undertaken on the basis of two samples of 16,000 children—approximately 8,000 boys, and 8,000 girls. These two samples were tabulated and the necessary statistical quantities were calculated.

This preliminary analysis shows that age is a poor criterion of body dimensions and hence an unsatisfactory basis for sizing. The four measurements from any one of which the other measurements can best be predicted and which, therefore, would be the most satisfactory as a basis for garment sizes are weight, girth of hips, oblique trunk girth, and stature. An even better basis for sizing would be a combination of two measurements. The best combinations of two, as

shown by the data collected to date, are stature and girth of hips; height of waist and girth of hips; height of waist and weight; and stature and weight.

Combinations of three measurements were also tried to see whether they would serve as a good basis for sizing. The best of these are height of waist, girth of chest, and girth of hips; stature, girth of chest, and girth of hips; height of waist, weight, and girth of hips; and stature, weight, and girth of hips. However, as far as the measurements taken to date show, a combination of two is sufficient to use as a basis for sizing. Including a third one does not substantially add any more information or give a more accurate prediction of the other dimensions. Before any final recommendations are made, these results will be verified by the analysis of all the data when the measuring is completed.

COTTON-FABRIC FINISHES

The finishing of cotton fabrics has become increasingly important to consumers. The usefulness of such fabrics can be greatly enhanced by special treatments, making them more resistant to soiling, creasing, and wrinkling, as well as providing a means of restoring their original appearance after laundering. The continued study of gelatin and starches used in textile sizing shows that the strength of starch films depends on their thickness and not on the kind of starch. However, starch films differ considerably in total elongation and folding endurance. Potato-starch films and fabrics sized with potato starch stretch the most. Then come canna starch, sweetpotato, rice, wheat, dasheen, and corn, in the order named. Canna and potato starches have the greatest folding endurance and wheat and dasheen the least.

HOUSING AND HOUSEHOLD EQUIPMENT

The increased availability of bottled gas and of electricity has made possible new forms of labor-saving equipment to farm as well as urban families. These long-desired conveniences coming at a time when cash incomes are limited have presented to farm families new problems in budget planning. Not only must expenditures for equipment find their place in the family budget, but choices of fuels, the kinds of equipment the family needs most, and the types best adapted to their particular requirements and pocketbooks, all must be considered. Homemakers are therefore asking for information to guide them in selecting equipment, as well as on its efficient use and care.

From the study of different fuels used for cooking, made in cooperation with the Bureau of Agricultural Engineering, the following conclusions have been reached: The amount of fuel consumed in cooking depends not only on the fuel but on the design of the range, the kind and size of utensil, and the menu. The comparative efficiency of fuels must also be based on data from both surface burners and oven cookery. In the studies conducted on given ranges and cooking utensils with meals chosen to represent as many typical cooking processes as possible and involving both the surface burners and the ovens, electric ranges proved to be almost three times as efficient as gasoline and kerosene, about twice as efficient as manufactured gas, and about one and four-fifths as efficient as bottled gas. The comparative speeds of the fuels tested were not the same as the efficiency of the fuels. For the 18 meals cooked in the laboratory (surface and oven), bottled gas proved to be the fastest. For surface cooking only slight differences in speed were found between different fuels. Manufactured gas had a slight advantage over all others, while kerosene was the slowest of the five fuels tested. Comparative costs for this particular set of meals cannot be used for estimating monthly or yearly costs of any given fuel even though the average rate paid for that fuel in this country can be determined.

To secure valid figures on average comparative costs of different fuels, laboratory studies must be supplemented with field studies in order to determine the actual consumption of the various fuels in different sections of the country, with varying climatic conditions and at different seasons of the year, by families of different sizes and of different types of racial, social, and economic backgrounds.

PUBLICATIONS AND INFORMATION SERVICES

By printed word, spoken word, picture, and exhibit, the results of the Bureau's work are made known to the public as soon as a project reaches completion. The list of bulletins and journal articles for the past year includes 27 titles representing material adapted to the use of homemakers and specialized research groups:

DEPARTMENT PUBLICATIONS

Farm family living outlook for 1938 (in cooperation with Bureau of Agricultural Economics). Misc. Pub. 297.

Methods and equipment for home laundering. By R. O'Brien and H. S. Holbrook. Farmers' Bull. 1497, rev.

Fabrics and designs for children's clothes. By C. L. Scott and M. Smith. Farmers' Bull. 1778.

Nuts and ways to use them. By E. F. Whiteman. Misc. Pub. 302.

Home-made jellies, jams, and preserves. By F. W. Yeatman and M. C. Stienbarger. Farmers' Bull. 1800.

When a woman buys a coat. By C. L. Scott. A pictorial supplement to Leaflet 117.

Apple recipes. Unnumbered pub.

Soybeans for the table. By E. F. Whiteman and E. K. Keyt. Leaflet 166. (In press.)

Dry skim milk. Unnumbered pub.

Family living in Knott County, Ky. By F. M. Williams, H. K. Stiebeling, I. G. Swisher, and G. S. Weiss. Tech. Bull. 576.

The sterilization of wool and its effect on physical and chemical properties of a woolen fabric. By H. Humfeld, R. E. Elmquist, and J. H. Kettering. (In cooperation with Bureau of Plant Industry.) Tech. Bull. 588.

Proposed minimum requirements of 3 types of upholstery fabrics based on the analysis of 62 materials. By B. V. Morrison and M. B. Hays. Circ. 483.

Food consumption of children at the National Child Research Center. By H. N. Hann and H. K. Stiebeling. Circ. 481.

Factors to be considered in preparing minimum-wage budgets for women. By G. S. Weiss, M. Waite, L. Stitt, and S. Stewart. (In cooperation with Women's Bureau and Bureau of Labor Statistics, Department of Labor.) Misc. Pub. 324. (In press.)

Diets of families of employed wage earners and clerical workers in cities. By H. K. Stiebeling and E. F. Phipard. Cir. 507. (In press.)

ARTICLES IN OUTSIDE JOURNALS

The food bill of American families. By H. K. Stiebeling. Agr. Situation 21 (7): 16–17. July 1, 1937.

Obtaining a panel for judging flavor in foods. By F. B. King. Food Research 2 (3): 207–219, illus. 1937.

The reactions of three all-wool blanket fabrics to three types of laundering. By R. E. Elmquist and M. B. Hays. Amer. Dyestuff Reptr. 26: 469–476, illus. August 9, 1937.

Labels that mean something. By R. O'Brien. Bull. of Natl. Retail Dry Goods Assoc. 19 (9): 70. September 1937.

Weights of food materials used in food preparation. By E. F. Whiteman and F. B. King. Jour. Home Econ. 29: 641–644. November 1937.

Cooked meats and poultry classified by chemical composition. By C. Chatfield. Jour. Amer. Dietetic Assoc. 13: 312–319. November 1937.

Some previews of an analysis of American diets. By H. K. Stiebeling. Medical Woman's Jour. 44: 313–317. November 1937.

Levels of living of the nation's families. By D. Monroe. Jour. Home Econ. 29: 665–670. December 1937.

A consumer classification and specification for cotton Turkish towels. By M. B. Hays. Rayon Textile Monthly 19 (4): 85–86, 112, illus. April 1938.

Experimental vanadium poisoning in the white rat. By E. P. Daniel and R. D. Lillie. (In cooperation with the U. S. Public Health Service.) Pub. Health Repts. 53: 765–777, illus. May 13, 1938.

A service study of four qualities of cotton Turkish towels. By R. E. Rogers and M. B. Hays. Jour. Home Econ. 30: 406–412, illus. June 1938.

Turkish towels and specifications. By M. B. Hays. Jour. Home Econ. 30: 395–396. June 1938.

Approximately 100 press releases based on data from the consumer purchases study have been widely used in newspapers and trade journals and have stimulated editorial comment and formed the basis for many interpretive articles.

An increasing number of extension workers are using the weekly Market Basket release reporting new developments in foods and nutrition as the foundation for local articles. Metropolitan dailies also run this material regularly in their pages for women readers.

Since January 1938 the National Farm and Home Hour radio program has been carried by a network of 93 stations with coast-to-coast coverage. In cooperation with the Radio Service of the Department, a representative of the Bureau speaks each week on this program, thus keeping homemakers currently informed of the ways in which science can serve them in the daily running of the household. Listeners to 50 of these 7-minute broadcasts wrote 85,875 letters to the Bureau requesting bulletins and asking specific questions on a variety of subjects affecting the health and well-being of the family.

To let professional home economics workers and teachers know of available source material, mounted sets of the latest bulletins and the charts on clothing selection, nutrition, and meat cookery, were circulated to 62 State and regional conferences. During the annual meeting of the American Home Economics Association thousands of visitors came to the Bureau's booth to look over publications and urge the preparation of more bulletins and illustrative material on all phases of home economics.

U. S. GOVERNMENT PRINTING OFFICE: 1938

For sale by the Superintendent of Documents, Washington, D. C. - - - - Price 5 cents

REPORT OF THE DIRECTOR OF PERSONNEL, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF DIRECTOR OF PERSONNEL,
Washington, D. C., June 30, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: Herewith I submit a report of the work in the Office of Personnel for the fiscal year ended June 30, 1938.

W. W. STOCKBERGER, *Director.*

Personnel administration in the Department is characterized by a positive and dynamic program formulated to meet the growing and ever-changing needs of the functional work performed in the various operating agencies. The work is a combination of centralized functional order and arrangement of duties coordinated with a decentralized system established in each of the bureaus and agencies. The policies and activities of the Office of Personnel must be entirely reflective of the major assignments and the rising needs of the Department as a whole. It is not concerned with the individual functions but with the combination of functions which comprise the entire institution. The Personnel Office assumes considerable responsibility for selection and placement of personnel, in the promotion of employees, in the general departmental program of safety and welfare, and in all of the related phases of management which increase the satisfaction of the workers and at the same time contribute greater efficiency to the working plans of the Department. This in no way removes the original control vested in the bureaus but enables the Office of Personnel to offer them more assistance in the performance of their personnel work. Together the bureaus and the Office are raising the management of personnel beyond the earlier stages where the work consisted only of orderly procedure and record keeping. The trend, like that of society and enterprise, is away from individual and toward group control. It affords opportunities for coordinating activities with resulting benefit to all. Through division of labor and responsibility, constant progress is made in developing higher standards in personnel work. These protect the morale of employees in the Department and lend encouragement to more effective administration.

The widening scope of the activities of the Department have brought the economic and social features of its work ever closer to the immediate needs of the Nation. In order that their services may be responsive to public and national needs and demands, employees who are selected for the work of the Department must be of the highest type as to ability, training, and personal aptitude. To see that appointees satisfactorily meet these requirements is a major responsibility of personnel officers. The work to be done requires able administrators and trained assistants who appreciate the importance of proper selection and training of secondary employees in order that they may be competent to advance into more responsible positions and to perform the required techniques thereof in the prescribed and acceptable manner.

There is a growing interest on the part of employees to learn more about the broader phases of the work of the Department, and various agencies afford opportunities for training in existing lines of work or in new ones that from time to time arise. The personnel program is being adapted to meet the recognized need for the coordination of training activities and for the develop-

ment of sufficient flexibility in organization structure to provide for any adaptations made necessary by changing policies. The ability to adjust the personnel and the organization to meet these changing policies is one of the most responsible features of the personnel work.

The coordination of the employees to meet the functional program of a department vested with numerous duties can only be performed by a scientific approach to the question of personnel management and the selection and adjustment of the employees involved. As the functional work changes from time to time so must the personnel policies and procedures. To be successful, this must be based upon a greater understanding of the human resources available and upon adequate personnel research that will aim in directing the human effort along the lines formulated by the policy leaders of the organization.

IN-SERVICE TRAINING

During the year a survey was made of current training programs that included: Staff meetings held regularly for executives and supervisors for the discussion of problems of policy, administration, and supervision; seminars for scientists and technicians; annual and semiannual conferences of several days' duration for field staffs; intensive training programs lasting several weeks, usually for beginning professional employees and occasionally for other employees where the acquisition of new skills was necessary; promotional training given to employees selected for advancement; and general information about bureau functions given periodically to all employees of an office or project. These training programs are carried on by staff and line supervisors of the bureaus. Participation by the Office of Personnel has, for the most part, been limited to helping plan programs, prepare instruction manuals, select instructors and training officers, develop training techniques, and evaluate the results of training.

Plans have been formulated that will permit of an expansion along the lines of employee-training policy in Washington and in the field. Emphasis will be placed on training for supervisors of all grades in the broader aspects of Department policy and administration, on the preparation of selected employees for promotion, and on special training for scientists and technicians.

In order to facilitate this activity the Office has encouraged the selection of more training officers by the bureaus and by their larger divisions and regional offices. These staff assistants will devote all of their time to placing and directing training programs. Additional steps are being taken to develop more accurate standards for measuring the effectiveness of in-service training.

The staff on training also made a survey of the Department's policies affecting personnel relations with universities and colleges. Arrangements were made for colleges and universities to allow credit for certain types of research and investigation carried on in the Department. Several universities and colleges, in cities where the Department has numerous employees, offered evening courses of value to employees, and several bureaus have appointed vocational advisers to help employees plan educational programs. The Office has participated in and will help to expand such post-entry educational opportunities for employees as a part of the general plan for increasing the efficiency of the Department's personnel.

SAFETY WORK

The year 1937 marked the beginning of an organized program of safety work for the Department as a phase of the general personnel management. The principal work of the safety staff has been to establish a uniform system of recording and reporting for the various bureaus, to develop cooperative plans for the use of safety machines in conjunction with the interdepartmental safety council and with representatives from each of the bureaus of the Department, and to conduct a general survey of positions involving hazardous lines of work and sources of potential injuries on the work projects of the Department. A survey of work projects in the field was started.

The widely diversified activities carried on by the 26 bureaus and offices of the Department range from the least hazardous, such as clerical office workers, to the most hazardous, such as quarrying, excavating, and lumbering. The most hazardous work is not confined to any one bureau but to a number of them carrying on such work as drainage, road construction, soil conservation, flood

control, lumbering, forestry, and farm engineering. In practically all of these activities most of the accident hazards of both light and heavy construction work are found. The handling of heavy motorized machinery such as steam and power shovels, draglines, derricks, excavators, fresnos, tractors, trucks, and other equipment used for excavating, ditching, dam building, and similar work—together with the fact that much of this work is carried on in remote sections of the country where long-haul transportation and labor camps are necessary—all add to the hazards of such operations. Some of the greater hazards are found in the several hundred stone quarries operated by the various bureaus over the entire United States. The bureaus dealing with the harvesting and marketing of field and garden crops, fruits, and various products are exposed to peculiar health hazards as well as a number of industrial accident hazards during the inspection and transportation of these crops. In the chemical laboratories and in the field where research work is carried on by these organizations there are great health and accident hazards, particularly in the mixing, handling, and spreading of poisonous dusts for insect, parasite, and rodent control.

Chemical laboratories are not the worst hazard of the bureaus working to prevent diseases of our farm cattle. Handling all kinds of animals for inoculation, taking blood samples, etc., produces many injuries. Departmental workers occasionally become infected with the disease they are fighting, especially when coming in contact with hogs and beef or dairy cattle. Here again the hazards of industry are encountered in the inspection of meats and dairy products.

The safety staff has begun the coordination of accident-prevention programs carried on by the bureaus. This is reflected in a periodic accident report complying with the rules of the American Standards Association wherein all Federal accidents are carefully analyzed, causes ascertained, and future preventive methods suggested. In addition, bulletins and literature on accident prevention, fire prevention, sanitation, and health were widely distributed throughout the operating offices of the Department.

Field inspections were made in a number of bureaus, covering projects in some 15 States. This phase of the work will be materially developed in the coming year. The work of the staff also included representation at numerous meetings of safety, sanitation, and fire-prevention groups, at several of the national committees on accidents, etc., and the National Safety Congress at Kansas City. It also involved the participation in the radio program of the farm safety section.

The first periodic monthly accident report for the Department was published in January 1938.

Table 1 shows a summary of the safety data accumulated to date.

TABLE 1.—*Accidents to Department employees, January–June 1938*

Month	Average workers	Total time worked	Deaths	Disabling injuries	Frequency per million man-hours
	Number	*Man-hours*	*Number*	*Number*	
January	175,495	28,956,983	5	763	26.52
February	176,307	26,627,644	1	590	22.19
March	186,362	32,907,915	9	620	19.11
April	192,093	31,251,866	8	476	15.49
May	206,322	33,159,259	3	546	16.56
June	179,206	30,134,042	6	554	18.58

APPOINTMENTS, SEPARATIONS, AND PROMOTIONS

On June 30, 1938, there were 68,431 employees serving under formal appointment by the Secretary of Agriculture as compared with 60,229 on June 30, 1937. This is partly accounted for by the placement of the field force of the Farm Security Administration, except project workers, under formal appointment by the Secretary of Agriculture on July 1, 1937. The gain is also brought about by the transfer of the land-utilization work of the Farm Security Administration to the Bureau of Agricultural Economics, increasing the force of the latter organization from 2,745 to 3,375, a gain of 630. There was also a gain in the Department rolls of 578 employees in the Soil Conservation Service and a loss of 659 in the Forest Service.

There was a decrease in the number of employees in the Agricultural Adjustment Administration from 4,394 on June 30, 1937, to 3,001, a net decrease of 1,393.

Table 2 reflects the appointments and separations in the Department of Agriculture for the last 5 years.

TABLE 2.—*Personnel activities of the Department of Agriculture, 1934–38*

Year ended June 30	Employees on rolls of Department			Field stations	Employees appointed	Separations from the Department
	Departmental service	Field service	Total			
1934	10,032	[1] 28,591	38,623	1,451	[2] 31,434	[3] 19,355
1935	11,437	[4] 32,643	44,080	1,864	[5] 29,092	[6] 23,635
1936	11,382	[7] 42,140	53,522	1,864	[8] 30,634	[9] 21,192
1937	[10] 13,371	[11] 46,858	60,229	2,924	[12] 34,561	[13] 27,854
1938	11,185	[14] 57,246	[15] 68,431	2,648	41,677	33,475

[1] Includes 80 in foreign service.
[2] Includes 11,667 in Agricultural Adjustment Administration.
[3] Includes 6,647 in Agricultural Adjustment Administration.
[4] Includes 52 in foreign service.
[5] Includes 8,249 in Agricultural Adjustment Administration.
[6] Includes 7,456 in Agricultural Adjustment Administration.
[7] Includes 52 in foreign service.
[8] Includes 5,186 in Agricultural Adjustment Administration.
[9] Includes 5,821 in Agricultural Adjustment Administration.
[10] Includes 2,329 in Resettlement Administration.
[11] Includes 88 in foreign service.
[12] Includes 1,336 in Agricultural Adjustment Administration.
[13] Includes 2,435 in Agricultural Adjustment Administration.
[14] Includes 103 in foreign service.
[15] Includes 11,091 in Farm Security Administration.

On June 30, 1938, there were 1,750 collaborators serving without compensation who are not included in table 2.

The turn-over of permanent employees during the year was 5.05 percent, as compared with 5.12 percent during the preceding year, 6.88 percent in 1936, and 7.19 percent during the year 1935.

The number of promotions both within the grade and from grade to grade was 17,639 during the year, as compared with 11,960 in 1937, and 10,815 in 1936.

RECORD OF LEAVE

Under the new leave acts of March 14, 1936, all employees were allowed annual leave at the rate of 26 days for the years 1936 and 1937. Annual leave accumulated since April 1, 1933, could be carried forward for taking in 1936. All employees were allowed sick leave of 1¼ days per month, accumulative from January 1, 1936, with a provision permitting an advance of 30 days' sick leave beyond the accrued leave in cases of serious illness. Prior to January 1, 1936, employees in Washington were allowed 30 days' sick leave, while the field force were allowed only 15 days, neither being accumulative.

Table 3 shows the distribution of annual and sick leave used by employees in Washington in the calendar year 1936. The average annual leave taken by the men and women in Washington was 19.9 days as compared with 14.4 days in 1935. The average for employees in the field was 14.7 days as compared with 11.4 days in the previous year.

Employees in Washington used an average of 6.9 days sick leave in 1936, a decrease of 1.9 days over 1935 and a decrease of 0.6 day over the average for the previous 8 consecutive years, which is the lowest average in any of these 8 years. There were 599 employees, or 5.7 percent, who used more than the 15 days sick leave earned during the calendar year. The total number of days taken by the 5.7 percent of the employees who used advanced sick leave was 15,609, or 21.5 percent of the total sick leave taken by all the employees.

In the field there was a slight increase in the amount of sick leave taken, the average being 2.9 days as compared with the 8-year average of the 2.8 days. There were 681 employees, or 2.7 percent of all the employees in the field, who took advanced sick leave, the total amount of sick leave taken by them being 16,855 days, or 22 percent of the total leave taken.

TABLE 3.—*Distribution of employees in Washington according to number of days of annual and sick leave used, calendar year 1936*

Days taken (number)	Annual leave		Sick leave		Days taken (number)	Annual leave		Sick leave	
	Employees [1]	Total taken	Employees [1]	Total taken		Employees [1]	Total taken	Employees [1]	Total taken
	Number	*Days*	*Number*	*Days*		*Number*	*Days*	*Number*	*Days*
0	161	0	1,937	0	17	427	7,259	34	578
1	85	85	698	698	18	443	7,974	49	882
2	85	170	805	1,610	19	447	8,493	24	456
3	71	213	646	1,938	20	530	10,600	36	720
4	78	312	626	2,504	21	534	11,214	22	462
5	108	540	608	3,040	22	567	12,474	30	660
6	117	702	522	3,132	23	540	12,420	37	851
7	136	952	504	3,528	24	592	14,208	14	336
8	177	1,416	485	3,880	25	677	16,925	18	450
9	151	1,359	464	4,176	26	967	25,142	15	390
10	191	1,910	450	4,500	27	448	12,096	17	459
11	209	2,299	423	4,653	28	346	9,688	10	280
12	219	2,628	648	7,776	29	214	6,206	14	406
13	258	3,354	348	4,524	30 and over [2]	738	23,206	228	7,863
14	312	4,368	337	4,718					
15	316	4,740	418	6,270	Total	10,518	208,937	10,518	72,556
16	374	5,984	51	816					

[1] Not including employees serving a fractional part of the year.
[2] 30 and over for both annual and sick leave.

Average number of days annual leave, 19.9; average number of days sick leave, 6.9.

Table 4 gives the distribution of annual and sick leave taken by employees in Washington during the calendar year 1937. Men and women in Washington averaged 20.6 days annual leave in 1937 as compared with 19.9 days in 1936. The average for field employees was 18.4 as compared with 14.7 days in 1936.

TABLE 4.—*Distribution of employees in Washington [1] according to number of days of annual and sick leave used, calendar year 1937*

Days taken (number)	Annual leave		Sick leave		Days taken (number)	Annual leave		Sick leave	
	Employees [2]	Total taken	Employees [2]	Total taken		Employees [2]	Total taken	Employees [2]	Total taken
	Number	*Days*	*Number*	*Days*		*Number*	*Days*	*Number*	*Days*
0	237	0	2,153	0	17	285	4,845	95	1,615
1	64	64	744	744	18	374	6,732	72	1,296
2	52	104	704	1,408	19	381	7,239	61	1,159
3	84	252	596	1,788	20	359	7,180	85	1,700
4	85	340	554	2,216	21	393	8,253	45	945
5	88	440	498	2,490	22	441	9,702	39	858
6	105	630	460	2,760	23	483	11,109	27	621
7	118	826	386	2,702	24	509	12,216	24	576
8	113	904	372	2,976	25	543	13,575	22	550
9	141	1,269	319	2,871	26	600	15,600	15	390
10	188	1,880	346	3,460	27	396	10,692	23	621
11	178	1,958	328	3,608	28	320	8,960	20	560
12	208	2,496	298	3,576	29	265	7,685	12	348
13	212	2,756	204	2,652	30 [3]	1,122	38,935	229	9,104
14	229	3,206	181	2,534					
15	305	4,575	148	2,220	Total	9,195	189,495	9,195	60,508
16	317	5,072	135	2,160					

[1] Not including Farm Security Administration.
[2] Not including employees serving a fractional part of the year.
[3] 30 and over.

Average number of days annual leave, 20.6; average number of days sick leave, 6.6.

During the years 1936 and 1937 under the new sick leave act, the average sick leave taken by the men and women in Washington was less than in any year of the 8 previous consecutive years. The average sick leave used in 1936 was 6.9 days and in 1937 6.6 days as compared with an average of 7.5 days for the 8 preceding years. Due to the cumulative provision of the sick leave law greater protection is afforded the employees against prolonged illness, and it seems that

employees are using less sick leave for minor illnesses in order to save their leave in the event of a serious illness.

There were 904 employees in Washington, or 9.8 percent, who used more than the 15 days' sick leave earned during the calendar year 1937. The total number of days taken by this group was 22,503, or 37.2 percent of the total sick leave taken by all the employees.

In the field where the provisions of the sick leave act are the same as for the Washington employees, the average sick leave taken during 1937 was 3.6 days as compared with 2.9 days for the year 1936 and an 8-year average of 2.8 days. Eight and one-half percent of the employees in the field took 44,646 days and 91.5 percent used only 45,394 days.

During the calendar year 1937, 23 percent of the employees in Washington and 48 percent of the field force did not take any sick leave. The past 8-year average of employees taking no sick leave was 23 percent for the Washington employees and 52 percent for the field.

WORK INCIDENT TO APPOINTMENTS, TRANSFERS, AND PROMOTIONS

Changes affecting personnel in the Department required contacts with the Civil Service Commission and the procurement of authorities for appointment, transfer, reinstatement, promotions, etc., as indicated in table 5.

TABLE 5.—*Personnel changes in the Department of Agriculture, 1934–38*

Item	1934	1935	1936	1937	1938
Certificates from register	1,510	1,648	1,948	1,425	3,696
Reinstatement certificates	481	416	481	442	366
Certificates for change in status	254	910	1,388	2,166	2,916
Transfer certificates	465	220	452	267	442
Authorities for temporary appointments	4,848	740	771	4,700	3,278
Authorities for extensions of temporary appointments	4,031	1,466	[1] 270	941	979
Authorities for extensions of suspensions	3	2	3	7	9
Civil-service examinations requested	29	110	124	65	42

[1] The material reduction in this item under previous years may be accounted for by the fact that the various bureaus and offices of the Department have been filling more or less temporary vacancies by probationary, for duration of work, appointments in which cases no extensions of temporary appointments are involved.

In continuation of the announced policy of filling vacancies by promotion, 271 vacancies were published on bulletin boards for filling jobs in Washington, D. C. The applications received from these postings and the applications received from postings in the previous year were certified to the various bureaus and offices for consideration when vacancies occurred.

Table 6 gives information on how permanent vacancies in Washington, D. C., were filled during the year.

TABLE 6.—*Permanent vacancies in Washington filled from July 1, 1937, to June 30, 1938*

Year and month	Transfer or promotion within the bureau		Transfer or promotion from other bureaus		Recruitment outside Department		Total vacancies filled	
1937	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
July	150	65½	27	17	28	17½	160	100
August	120	60	39	20	39	20	198	100
September	102	58	33	19	40	23	175	100
October	106	58	16	9	62	33	184	100
November	115	57½	27	13½	58	29	200	100
December	112	54	24	13	63	33	189	100
1938								
January	83	55	12	8	55	37	150	100
February	76	49	23	15	56	36	155	100
March	77	55	16	11	47	34	140	100
April	95	58	25	15	44	27	164	100
May	79	60	10	7	44	33	133	100
June	119	61	32	17	42	22	193	100
Total	1,179	58	284	14	578	28	2,041	100

In January 1938, the Office began work on installing a statistical punch card for personnel. This job was completed before the end of the year for the entire personnel of the Department. In addition a punch card for recording leave was devised and punched for all employees of the Department who were granted leave. A personnel questionnaire was devised and submitted to all employees in order to bring their qualifications up to date on the records of the Department. A qualification punch card was developed and in the next fiscal year the questionnaires will be coded and cards punched.

Much credit is due the bureaus and offices of the Department which provided funds to pay salaries of employees engaged on this work.

During the year 117,040 personnel actions were handled as compared to 98,635 personnel actions for the previous fiscal year.

RETIREMENT RECORDS

During the year 378 applications for service credit, 1,690 applications for refund of retirement deductions, and 4,009 master retirement record cards were completed, audited, and certified.

Retirements from the service and annuities of those retired are shown in tables 7 and 8.

TABLE 7.—*Number of employees retired, 1934–38*

Year ended June 30	Annuity retirements in class of—				Disability retirements in class of—				
	Professional	Subprofessional	Clerical, administrative, and fiscal	Custodial	Professional	Subprofessional	Clerical, administrative, and fiscal	Custodial	Cases disposed of
1934	51	63	58	24	12	12	28	11	259
1935	46	65	24	12	10	14	29	5	205
1936	29	50	18	6	11	19	18	3	154
1937	35	42	18	5	8	20	20	5	153
1938	38	48	18	12	11	15	27	1	170

TABLE 8.—*Averages of the annuities in the various groups, 1934–38*

Group	1934	1935	1936	1937	1938
Professional and scientific	$1,102.22	$1,039.81	$1,068.59	$1,049.04	$1,150.35
Subprofessional	946.81	960.08	990.43	1,027.02	1,068.48
Clerical, administrative, and fiscal	946.83	826.35	865.08	887.82	901.68
Custodial	757.72	728.50	654.05	708.79	902.35

The minimum annuity granted was $158.88. The largest straight life annuity was $1,335.72, and the largest increased annuity with forfeiture was $1,351.68. Eight of the optional retirements occurred in the 70-year, six in the 62-year, and two in the 65-year age group. It is interesting to note that no females took advantage of their optional retirement rights during the past 2 years.

Under the law, exemptions from compulsory retirement must be approved by the President. Extensions in the service upon reaching retirement age have been granted to only 19 employees since July 1, 1932. Some of these employees, however, were granted more than one extension.

During the year continuance in the service beyond retirement age was granted to a principal chemist, Office of Experiment Stations; a principal horticulturist, a senior pathologist, and a principal pathologist, Bureau of Plant Industry; an associate petrographer, Bureau of Public Roads; a principal agronomist, Soil Conservation Service; a senior attorney and a regional law officer, Office of the Solicitor.

CLASSIFICATION OF POSITIONS

The classification of positions under the Classification Act of 1923, as amended, involved an intensive review of positions in the emergency phases of

the departmental work. The regular work was expanded to meet the needs of special agencies such as the Federal Crop Insurance Corporation, Federal Surplus Commodities Corporation, and the Farm Security Administration. The work involved a large number of surveys of types of work and offered more assistance to the bureaus in formulating new organization plans and functional charts and supplied added cross-section studies on lines of work of especial concern to the expanding functions of the Department. The classification staff continued its detailed review of Washington positions and made more extensive spot checks of field headquarters. Through this information they were better able to evaluate lines of work which had changed during the past few years and thus assist the administrative officers in making a proper distribution of the appointments. The work developed to a point where the bureaus were constantly seeking service and advice in their classification and organization problems.

A total of 6,799 appointments and changes in status in Washington employees were acted upon during the year. The number recorded is slightly greater than the preceding year because of the establishment of new operating units in the Department as a result of acts of Congress.

The consolidation of land-utilization units of the Farm Security Administration with the Bureau of Agricultural Economics and the creation of the Federal Crop Insurance Corporation and the Federal Surplus Commodities Corporation have contributed towards this increase. Many cases are actually reviewed and returned without action. The advice and service rendered in such cases is not reflected in the total number of actions that pass through the Office for final consideration at the Civil Service Commission or by the Director of Personnel. Each case, whether it involves a change in duties or an appeal for reallocation, involves careful job analysis and comparison with similar positions throughout the Department. The purpose of this work is to equalize the responsibility of class assignments so that the principle of classification may be maintained with resulting equal pay for equal work.

There has been a marked decrease in the number of appeals handled over the year preceding as more attention was given to the individual and group job adjustments of employees. A summary of this activity insofar as it relates to the personnel in Washington for the past 5 years is given in table 9.

TABLE 9.—*Appointments and changes in status of employees of the Department of Agriculture, 1934–38*

Year ended June 30	Appointments to new positions	Changes in duties	Changes to vacancies	Appeals	Total
1934	5,561	1,274	2,329	15	9,179
1935	1,634	3,315	3,260	45	8,254
1936	1,905	3,698	2,145	45	7,793
1937	911	4,002	1,403	23	6,339
1938	1,417	3,921	1,451	10	6,799

In addition to those shown in table 9 a number of positions have been reviewed from the field service and classifications assigned according to departmental standards. The volume of such transactions has remained somewhat constant over the year and does not represent any unusual changes in the Department. As the reorganization of the larger field offices has been completed, the field personnel has reached a normal level. Material assistance has been rendered to the field service in various reorganization studies and in general advice on the classification and the proper alignment of positions. These organization studies help to establish Department standards, clarify lines of bureau responsibility, and set down division and section responsibilities and authority which results in greater operating efficiency for the whole.

A survey was made of the various positions connected with the Forest Service headquarters in Milwaukee. A comprehensive management and classification study was prepared on the Commodity Exchange Administration, including the Washington, Chicago, and New York offices and personnel. In addition cross-section studies on grade levels, duty series for several types of work, and other occupational studies were continued. An extensive survey was made in con-

junction with the Civil Service Commission on all audit and accounting positions in the Department. This was conducted partly through a direct audit and partly through a questionnaire method. In addition a field-inspection survey was made, which included an analysis of work in four of the large bureaus of the Department which maintained decentralized fiscal offices. Approximately 40 fiscal headquarters throughout the country were visited. The information secured was carefully analyzed along with various bureau procedures and practices. The report has served and will continue to serve for a more effective evaluation of fiscal operations and will provide for a more equitable classification of the positions in this field of activity. These inspections provide information that help to evaluate the work performed and aid the classification staff to interpret and equalize the work activities of the Department over a large area. They serve to encourage the employees and remove many of the mental and physical obstacles which confront those who work at a distance from the headquarters and who remain somewhat unfamiliar with the details and procedures that are involved in the reallocation of positions.

Members of the staff have represented the service at the Civil Service Assembly and in other organizations concerned with classification. Active participation in these organizations enables the Office to secure a wider range of information and helps to spread desirable facts on the procedures involved and at the same time creates a better understanding among the employees. The trained assistants have rendered material help to the Department in improving the general attitude towards classification and in informing employees as to the requirements of duty assignments, as to the evaluation of responsibility, as to the interpretation of job descriptions and job levels and related problems of organization that are presented either informally or officially to the Office. The surveys of this nature help to clear many of the intangible problems of classification, facilitate administration, and improve the employee attitude towards the service. The work helps in maintaining a just and uniform standard of work and pay for similar rates of performance throughout the many agencies of the Department.

INVESTIGATIONS

During the year 71 personnel, 6 Civilian Conservation Corps camps, and 31 miscellaneous investigations were conducted by the Division of Investigations. In addition, 880 Agricultural Adjustment Administration contracts were investigated to discover (1) whether the payees received the payments to which they were entitled, (2) erroneous payments, and (3) forgeries of payment checks. Because of the Division's findings, a substantial amount of money was recovered for the Government, and final settlement of these cases will result in the eventual receipt by the payees of the money to which they are rightfully entitled.

A total of 895 cases, most of which were for the imposition of disciplinary penalties on account of delinquency, misconduct, and fiscal and other irregularities on the part of employees, received consideration by the Division of Investigations.

Because of the large number of special investigations and the limited number of investigators, no progress was made with the contemplated periodical investigation of field stations and offices. Since additional investigators are now available, however, it is hoped that considerable progress with this phase of the Division's work will be possible during the coming year.

The year's work resulted in 1,044 separate personnel actions, as follows:

	Number
Suspension without pay pending investigation	77
Preferment of formal charges	25
Dismissal as a result of formal charges	16
Reprimand by chief of bureau	104
Reprimand by Secretary	11
Reduction in grade and/or salary	2
Reduction in grade and/or salary, and reprimand by Secretary	3
Reduction in grade and/or salary, and transfer	4
Leave without pay for disciplinary reasons	8
Suspension without pay and reprimand by Secretary	75
Suspension without pay, reprimand by Secretary, and reduction in grade and/or salary	2
Suspension without pay, reprimand by Secretary, reduction in grade and/or salary, and transfer	1
Suspension without pay, reprimand by Secretary, and transfer	3

Appointment terminated with prejudice	76
Resignation accepted with prejudice	57
Action taken for other than disciplinary reasons	580
Appointment terminated without prejudice	368
Resignation accepted without prejudice	173
Other	39
Total	1,044

EMPLOYEE ACTIVITIES

The employee organizations through the Welfare Association and the Athletic Recreational Association have continued to sponsor numerous activities in the development of educational, recreational, and athletic facilities for the various groups of workers. They have made possible additional welfare improvements. They have contributed materially to improving the acquaintanceship between employees and in developing self-expression and participation in extracurricula activities, which now constitute an important place in the social life of the Department.

The regular Welfare Association publication was not issued during the year but the Athletic Recreational Association has published a very complete handbook showing the types of work which it sponsors and the various officers connected with it. Among the interests sponsored are baseball, basketball, bowling, dramatics, camera craft, swimming, golf, hiking, horseback riding, skating, softball, trips, and other activities. These activities have received the general interest and support of the departmental employees.

U. S. GOVERNMENT PRINTING OFFICE: 1938

REPORT OF THE CHIEF OF THE BUREAU OF PLANT INDUSTRY, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
Washington, D. C., August 31, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith a report of the work of the Bureau of Plant Industry for the fiscal year ended June 30, 1938.

Sincerely yours,

E. C. AUCHTER, *Chief.*

CONTENTS

	Page		Page
Introduction	1	Plant exploration and introduction	18
Changes in personnel	2	Seed investigations	19
Cereal crops and diseases	2	Soil fertility investigations	19
Cotton and other fiber crops and diseases	5	Soil microbiology	20
Drug and related plants	7	Sugar plant investigations	20
Dry land agriculture	8	Tobacco and plant nutrition	22
Forage crops and diseases	9	Western irrigation agriculture	24
Forest pathology	11	Arlington Experiment Farm	24
Fruit and vegetable crops and diseases	12	Experimental greenhouses	25
Mycology and disease survey	17	Publications, information, extension	25
Nematology	17	List of publications	25

INTRODUCTION

That the long-time research program of the Bureau of Plant Industry is fundamentally sound in its philosophy and major objectives has been amply demonstrated in recent years, during which the Bureau has been able to supply abundant basic information on field and horticultural crops that is essential to the formulation and prosecution of various governmental action programs. While maintained on a high plane of scientific procedure, the plant-research program has at the same time been flexible enough to permit advisable shifts in emphasis in order to meet most immediately pressing problems. In this connection it should be pointed out that the greater value of plant research lies in the accumulation of results through years of patient study of problems involving infinite detail. It is from the rich background of long-continued experimentation that the solution of an immediate problem is most likely to evolve, although the chance of making a notable discovery, even in an unexpectedly short time, is always present. Continuity in research of this character affords, nevertheless, the greatest assurance of effectiveness. For this reason, plant research must retain always the long view and avoid aberrant shifts in procedure.

The following pages present summaries of definite progress in certain phases of the research of the Bureau during the fiscal year ended June 30, 1938. Much additional research was continued. The more significant results have been reported in the numerous publications listed herein. The results of other current research are in process of publication or will appear in future publications.

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CHANGES IN PERSONNEL

Frederick D. Richey, Chief of the Bureau since October 23, 1934, resigned as of March 10, 1938, and was succeeded by E. C. Auchter, formerly Assistant Chief and in charge of the Division of Fruit and Vegetable Crops and Diseases. M. A. McCall has continued as Assistant Chief of the Bureau besides being in charge of the Division of Cereal Crops and Diseases.

H. P. Gould, senior pomologist in the Division of Fruit and Vegetable Crops and Diseases, was designated as acting head of that Division from March 10 to the end of the fiscal year and was appointed principal horticulturist in charge as of July 1, 1938.

In line with the provisions of the Retirement Act, the following members of the technical staff were retired during the fiscal year: L. C. Corbett, principal horticulturist, Division of Fruit and Vegetable Crops and Diseases; George G. Hedgcock and William H. Long, senior pathologist, Division of Forest Pathology; Samuel L. Jodidi, physiologist, Division of Fruit and Vegetable Crops and Diseases; and Jacob O. Belz, associate biophysicist, Division of Cereal Crops and Diseases.

The death of Beverly T. Galloway on June 13 marked the passing of a distinguished figure in the Bureau's history. Having entered the service of the Department as vegetable pathologist in 1887, Dr. Galloway became the first Chief of the Bureau on its organization in 1901 and continued in that position until his appointment as Assistant Secretary of Agriculture in 1913. Later he left the Department to become dean of the College of Agriculture of Cornell University. In 1916 he returned to the Bureau in a scientific capacity and in the following years did notable work in the introduction and propagation of bamboos and nursery stocks. After his retirement in 1933 he continued to serve as collaborator without compensation. In the double role of scientist and executive he contributed much to the Bureau's development and scientific achievements.

CEREAL CROPS AND DISEASES

M. A. McCall, *in charge*

NEW STRAINS OF SWEET CORN

Two new strains of sweet corn developed in cooperation with the Louisiana Agricultural Experiment Station were increased and are being distributed for trial. A strain developed in cooperation with the Tennessee station also is being distributed. Investigations in cooperation with the Indiana station on the keeping quality of different inbred lines have indicated marked differences in the amounts of sugar in the fresh grain and in the rate at which the sugars are lost under storage conditions.

CORN WILT CARRIED BY FLEA BEETLES

In cooperative studies with the Bureau of Entomology and Plant Quarantine, the bacterial wilt organism has been found to be carried throughout the year in the bodies of corn flea beetles, and the beetles appear to be largely responsible for the overwintering of the organism. Early development of wilt appears to follow mild winters in which high survival of the beetles has occurred.

CULTURAL METHODS PROMOTE NITRATE ACCUMULATION IN WHEATLAND

Early plowing and clean cultivation of land for fallow in the Pacific Northwest resulted in a greater accumulation of nitrates and moisture and prevented their loss through weed growth. Soil moistures below the third foot and total nitrates are highly correlated with yield and quality of grain for making bread flour.

THATCHER WHEAT SURVIVES RUST EPIDEMIC

Another severe epidemic of black stem rust of wheat occurred in the Central States in 1937. The Thatcher variety produced satisfactory yields under severe rust conditions where other standard varieties of hard red spring wheat such as Marquis and Ceres were often nearly a failure. Thatcher was developed by hybridization in the cooperative wheat-breeding program of the Department and the Minnesota Agricultural Experiment Station. It was first distributed in 1934 and was sown on more than 4 million acres in the United States and

Canada in 1938. Its milling and baking quality has been pronounced satisfactory by important milling and baking interests not only in the United States but also in England. This confirms the experimental determinations previously made in the United States and Canada, in which Thatcher was about equal to Marquis in milling and bread-making quality. Thousands of selections from hybrids between standard hard red spring wheats and stem rust resistant varieties such as Hope, H–44, and Thatcher have been found to be highly resistant to both stem and leaf rust, and some of them are resistant also to bunt. Many appear to be excellent in yield and quality, and further improvement in the hard red spring wheats seems highly probable.

HOPE WHEAT HYBRIDS RESIST STEM AND LEAF RUST

The resistance of Hope spring wheat to stem and leaf rust also has been transferred by hybridization to both hard red winter and soft red winter types of wheat. These resistant selections are now being tested for yield and quality.

NEW WHEAT VARIETIES RESIST HESSIAN FLY

A new wheat highly resistant to the hessian fly in California is being increased for distribution. Two varieties of wheat, F. P. I. No. 94587 and Illinois No. 1 W–38, have been determined to be resistant to the strains of hessian fly occurring in the soft red winter and hard red winter wheat areas as well as to those occurring in California. These varieties have been crossed with various commercial types of wheat to develop adapted resistant varieties for different regions.

CROWN RUST RESISTANT OATS FOR DEEP SOUTH

Alber (C. I. 2766) and Berger (C. I. 2926), two closely related varieties of oats, were introduced in 1929 and 1931, respectively, from Uruguay by the Department and the Iowa Agricultural Experiment Station. These varieties are resistant to certain races of crown rust and have yielded well in experiments in Louisiana, Georgia, and Florida. Alber and Berger oats have yielded 75 percent more than the standard Red Rustproof variety during a 4-year period at the Louisiana station. About 200 bushels of Alber were distributed to Louisiana farmers in the fall of 1937. These varieties are similar to Red Rustproof, but are less hardy and appear to be adapted only to certain sections of the deep South. In those sections, however, they should make oat production much more certain.

NEW OATS FOR IRRIGATED FARMS

Bannock (C. I. 2592), a new smut-resistant oat variety developed in cooperation with the Idaho station from a Markton-Victory cross, was distributed to farmers of Idaho for growing under irrigation in 1938. Bannock is a midseason white oat similar in most characters to the Victory parent and is equal or slightly superior to Victory in yield besides being resistant to smut. Another oat variety (C. I. 3141), selected from a cross between Markton and Swedish Select, is being increased for distribution to farmers of Utah in 1939. This is a high-yielding, smut-resistant, stiff-strawed, midseason white oat developed cooperatively with the Utah, Idaho, and Montana Agricultural Experiment Stations.

NEW DISEASE-RESISTANT OATS FOR THE CORN BELT

Oat varieties resistant to smut, stem rust, and crown rust have been developed for the principal oat-producing areas in the Central States by crosses involving such varieties as Victoria, Markton, Richland, and Rainbow, which are resistant to one or more of these diseases. Some of the better of these hybrid selections have yielded 13 to 23 bushels per acre more than the standard variety Richland in experiments at the Iowa station. These new early, disease-resistant, productive oats seem to be especially promising for eastern Nebraska, southern Iowa, northern Missouri, and the central portions of Illinois, Indiana, and Ohio, where the crop very frequently suffers from rust and generally unfavorable conditions. There is some evidence that these oats also are resistant to some of the soil-borne organisms that attack oats in some sections. Promising selections of midseason oats with resistance to the rusts and smuts likewise have been developed from a Markton-Rainbow cross. These selections are not yet ready for distribution.

QUALITY IN BREWING BARLEYS REMARKABLY CONSTANT

Tests of the malting quality of barley, made at the cooperative experimental laboratory at Madison, Wis., with five varieties grown at six stations in 3 years, show that the relative ranking of these varieties is remarkably constant. This discovery, of great value to barley breeders, indicates that the quality of a particular selection probably will be maintained over a rather wide area. It thus appears feasible to breed and test barley for improvement in malting quality at a few strategic points. These results are also of value to maltsters who buy barley on a variety basis, as they can have considerable assurance that a given variety will tend to have about the same relative quality in comparison with others in the same area, wherever they are grown.

CHEVRON BARLEY RESISTS STEM RUST AND SCAB

The Chevron variety (C. I. 1111), selected from a barley introduced from Switzerland in 1914, was found to be highly resistant to stem rust during the epidemic of 1937. This resistance was evident at all of the cooperating stations in the upper Mississippi Valley where it was grown. Peatland, a selection from the same introduction, is equally as resistant to this disease. Chevron is more resistant to the scab disease than any known variety of barley, and it appears to have resistance to several other diseases also. This variety is being used extensively in hybridization.

RICE VARIETIES OF IMPROVED QUALITY PREFERRED BY THE CONSUMER

More than 100,000 acres of the improved varieties of rice of good table quality, viz, Fortuna, Rexoro, and Nira, were grown in the South in 1937. These varieties were developed and distributed by the Department in cooperation with the Louisiana station. In recent months milled rice of these varieties was quoted at $4.85 to $5.50 per 100 pounds, in comparison with $2.60 to $2.85 for Blue Rose and Early Prolific, the leading commercial varieties grown in the Southern States. These prices indicate a public preference for the improved varieties. The Calady variety, also developed by the Department, was grown on 14,700 acres in California in 1937. Calady is a medium-grain rice of good quality. The yields of Calady have been about 20 percent less than those of Caloro in recent years. However, experiments in 1937 indicate that satisfactory yields of Calady may be obtained by heavy applications of ammonium sulphate (200 to 250 pounds per acre) at seeding time.

SORGHUM LEAVES CONTAIN MOST HYDROCYANIC ACID

More than 1,000 samples from sorghum plants were analyzed in cooperation with the Bureau of Animal Industry to determine the content of hydrocyanic acid, the substance that frequently causes poisoning in cattle and sheep. It was found that leaves may contain 3 to 25 times as much hydrocyanic acid as the corresponding stalks. Heads and leaf sheaths contained very little of the acid, and the mature grain was free from it. The upper (younger) leaves contained more than the lower leaves. The hydrocyanic acid content of the stalks decreased progressively from the top downward. The tip half of a leaf may contain considerably more than the lower half. Suckers and young side branches usually contained appreciably more than the older main stalk of the same plants.

FALL-SOWN SEED FLAX SUCCEEDS IN CALIFORNIA

Experiments with fall-sown flax in California, conducted by the California Agricultural Experiment Station with informal cooperation by the Department, have resulted, since 1932, in the establishment of a flax industry in that State, where 500,000 to 600,000 bushels are now grown annually. Almost the entire acreage consists of the Punjab variety, developed by the Department and distributed after its value had been determined by the California experiments. Other experiments demonstrated the value of flax as a nurse crop for alfalfa and the value of sesbania as a green-manure crop preceding flax. Date-of-seeding experiments have shown the importance of seeding flax in November or late October in California. Seeding earlier than this brings the flax into blooming so early that it may be subjected to the hazard of frost while in the tender blooming stage. Seeding after November delays ripening until the weather has

become hot enough to interfere with the development of the seed. Flax is a cool-weather crop, and temperatures above 90° F. during the growing period have been found to reduce yields.

LESS FREQUENT CULTIVATION CONTROLS BINDWEED AT LOWER COST

The method of killing field bindweed generally recommended has been that of cultivation every week to 10 days for two seasons, to destroy all green growth promptly, on the assumption that all leaves manufacture food materials and consequently prolong the life of the weeds. Field experiments during the last 3 years have shown that fully as effective control is obtained by cultivating every 12 to 21 days, or, more specifically, when the new shoots have reached a length of 4 inches or slightly more. This less frequent cultivation reduces the labor by half and affords a feasible method of control that is more likely to be put into general practice. These experiments appear to be confirmed by the results of numerous chemical analyses of the plants and roots. It was found that new shoots used more food material during the first week than they were able to manufacture, and in doing so they depleted the carbohydrate reserves in the roots. Cultivation thus gradually exhausted the food reserves in the roots, despite the fact that, as has been found, more than half of the total supply of sugars, dextrin, and starch in the roots was stored at levels below the reach of cultivating implements. It was found that bindweed seedlings became established and took on the characteristics of perennial plants within about 40 to 60 days after germination. This emphasizes the necessity of destroying the seedlings by cultivation while young, if at all possible, in order to avoid the numerous cultivations necessary in destroying the plants after they have developed underground rootstocks.

COTTON AND OTHER FIBER CROPS AND DISEASES

H. W. Barre, *in charge*

SPINNING VALUE OF COTTON INFLUENCED BY VARIETY AND GROWTH CONDITIONS

Spinning tests of seven varieties of cotton indicate that the variety determines in a large measure the strength of the yarn. These preliminary spinning researches show that there was a difference of more than 15 percent in the strength of yarns from different varieties of approximately the same length and fineness, indicating that inheritance is an important factor in determining yarn strength. The average strength of yarn produced by these seven varieties at eight different locations shows that yarn strength was also influenced by location at which the cotton was grown.

DEVELOPMENT OF COTTON FIBERS IS INVESTIGATED

A study of the formation and growth of cotton fibers from the epidermal layer of the seed coats has furnished information of basic importance. It has been found that these fibers begin to form on the seed at the time the fruit buds bloom and that they continue to form for 3 or 4 days following the opening of the flower. Beginning about the seventh day after blooming, additional fiberlike cells begin to develop between the fibers formed earlier, and this continues until about the tenth or eleventh day after blooming. These cells, which protrude during this latter period, develop into fuzz fibers as distinguished from the cotton lint. All of these cells continue to elongate until about the time the boll reaches full size, which, in the upland varieties, is 16 to 18 days after blooming, when elongation ceases and the cell walls begin to thicken. In the smooth-seeded cottons no fiber or fuzz cells develop after the fourth day after flowering. The cellulose is deposited in layers on the inside of the primary cell wall from day to day until 4 or 5 days before the boll opens. The structure of the cell wall as it thickens has been carefully studied, and it is noted that the thickness of the daily rings is influenced by light and temperature and possibly by other growth factors.

TESTS FOR WILT RESISTANCE AID COTTON BREEDERS

In the study of cotton wilt, technique has been developed for testing resistance in the seedling stage and in the greenhouse that greatly shortens the time and expense necessary for determining comparative resistance of promising new strains and varieties. A regional wilt-variety study conducted cooperatively at

the experiment stations in nine States has revealed important indications concerning modifications of varietal resistance by seasonal factors, soils, fertilizers, etc., and has aided in selecting the varieties that are most productive and most valuable for growth in several sections of the Southeast and mid-South where wilt is especially destructive. Breeding work for wilt resistance has resulted in the development of a long-staple strain of Delfos type that seems to be highly resistant to wilt and is suitable for planting in Mississippi and Louisiana.

ALKALOIDS IN COTTON PLANTS RETARD ROOT ROT

Physiological and pathological studies of Texas root rot indicate that resistance to this disease is associated with the presence of certain alkaloids found in plant tissues. Studies are now being made of the factors that influence the proportion of these alkaloids in cotton as well as in plants that are immune to root rot.

NEW VARIETIES OF AMERICAN-EGYPTIAN COTTON

Increased interest is shown in the production of American-Egyptian cotton, partly because of the greater yield of the newer varieties developed by this Bureau in the breeding work at Sacaton, Ariz., and partly because of the price differential and the acreage control program. The S × P variety, produced from a Sakel-Pima cross several years ago, is now being widely grown and probably makes up 50 percent of the estimated 38,000 acres of American-Egyptian planted in 1938. This variety has outyielded Pima by 18½ percent, the increase being due very largely to the higher lint percentage of S × P. S × P is also favored because the seeds are less fuzzy and easier to gin. The highest yield obtained in 1937 with this variety was an average of 573 pounds of lint on 80 acres. While S × P is a little shorter than Pima, the mills seem to prefer it because of its more uniform length, and the price has been practically the same as for Pima.

Another new variety, developed by a backcross of Pima and S × P, seems to have considerable promise because of increased earliness. A leading cotton merchant of the United States, in commenting on this variety, recently stated: "It is unusually silky, has almost the feel of sea island or Egyptian Sakha 4, silkier than most commercial S × P, free of wasty short fibers, and very strong. This should not only make unusually strong yarn but produce cloth of better feel than most S × P and Pima. It might be better for the manufacturer of thread yarn than either of the other varieties reported because of its superior silkiness." This variety seems just as productive as varieties now in use and is much earlier, which indicates that it would be better adapted to the shorter growing seasons of the Rio Grande and San Joaquin Valleys. A test at State College, N. Mex., showed it to be about equal to S × P in yield and decidedly earlier.

MICRO-ORGANISMS DETERIORATE COTTON FIBERS

Preliminary field and laboratory studies reveal the presence of micro-organisms in cotton fibers soon after the cotton opens. The development of these organisms is influenced largely by temperature and moisture relations while the cotton remains in the field. Some of these organisms materially weaken the fiber without discoloring the cotton. Others cause the blue and black color so characteristic of cotton that has remained too long in the field after it opens. There was general complaint among certain manufacturers as to the quality of the 1937 crop. The studies indicate that the poor quality was due at least in part to the unfavorable weather during harvest and to the fact that the large crop could not be picked promptly. Studies are being made of the influence of variety, picking and harvesting procedure, etc., on the activities of these organisms that cause deterioration.

ONE-VARIETY COTTON COMMUNITIES RECEIVE PREMIUMS

There has been a marked increase in the number of one-variety cotton communities as well as in the acreage and production in these communities throughout the Cotton Belt. At the end of 1937 there were 814 such communities in 343 of the 850 cotton-producing counties in the 14 principal cotton-growing States. The total planted area was 2,434,367 acres, and the total production was 1,863,692 bales of cotton of improved quality with $\frac{15}{16}$- to $1\frac{1}{16}$-inch staple. On a basis of an average of 50 points premium per pound, or $2.50 a bale, the extra returns received by the growers in 1937 in premiums alone were about $4,500,000. When

this is added to the returns from the average acre increase of 40 pounds of lint, the total extra return throughout the United States in 1937 was about $13,000,000. Reports show that production of cotton in the United States of 1- and 1 1/32-inch staple (the lengths produced in practically all of the one-variety communities) increased from 11 percent of the crop in 1928 to 20 in 1937. The cotton manufacturers are becoming more and more interested in standardized production, because it enables them to get large even-running lots of cotton of uniform staple length and quality suited to their special needs. Many of the southeastern mills are now buying one-variety cotton from the same communities year after year. Effort is being made to have large lots of one-variety cotton assembled and handled in such a way as to keep this cotton from becoming mixed with other varieties and types as it moves through the channels of trade. Thus this cotton of superior quality can be delivered to foreign consumers in the large even-running lots in which it is produced in the one-variety communities.

ABACÁ (MANILA HEMP) CAN BE PRODUCED IN AMERICAN TROPICS

The urgent need for establishing, if possible, a secondary source of supply of abacá fiber (manila hemp) in the American Tropics has long been recognized. This fiber furnishes the raw material for all of our high-grade rope and is also a binder-twine fiber. There is no satisfactory substitute for it for marine cordage and transmission rope, and no sources of supply nearer than the Philippine Islands. After 16 years of necessary research and experiment it has been determined that abacá fiber of excellent quality can be produced in the American Tropics. In cooperation with an American plantation company, a field planting of more than 1,000 acres of abacá has been made in the Republic of Panama. Within the next 2 or 3 years it should be possible to determine definitely whether the commercial production of abacá fiber in the American Tropics is practicable.

BREEDERS ATTEMPTING TO BREED DRUG-FREE HEMP

The Marihuana Tax Act of 1937 requires all growers, importers, and processors of hemp to register and be licensed. As a result of growing public opposition to the cultivation of this drug plant, the continuation of hemp culture in the United States may be dependent upon eliminating as much as possible of the active drug principle from the plant. Preliminary tests indicate a possibility of ultimately obtaining a hemp variety with little or no active drug. Research on this problem is actively under way.

DIVISION OF DRUG AND RELATED PLANTS

W. W. Stockberger, *in charge*

PERILLA, SOURCE OF PAINT AND VARNISH OIL, ADAPTED ONLY TO SOUTH

Trial plantings in many localities of perilla, source of a valuable paint and varnish oil, showed that this crop is adapted only to the South and is subject to damage by soil-borne diseases. Harvesting experiments suggest that the loss of seed by shattering, which is a serious objection, can be reduced by cutting the crop slightly before the seed is fully ripe.

DEVIL'S SHOESTRING, A POSSIBLE COMMERCIAL SOURCE OF ROTENONE

The results of a survey of the possibilities of the native rotenone-containing legume *Tephrosia virginiana* (devil's shoestring) as an insecticide plant are reported in Technical Bulletin 595, issued during the year. In this survey the most toxic plants found contained 1.8 percent of rotenone. During the year superior strains were found with almost three times that much rotenone and with a toxicity approaching that of some of the commercial derris root on the market.

CALCIUM CYANAMIDE HELPS CONTROL MILDEW IN HOPS

The application of calcium cyanamide to the soil around the hop plants in early spring was shown to reduce the amount of downy mildew as the vines develop, and this, with the fertilizing value of the product, tends to increase the yield of hops under mildew conditions. The importance of careful application to prevent damage to the plants was emphasized to growers.

DRY LAND AGRICULTURE

C. E. LEIGHTY, *in charge*

SEASONAL SOIL-MOISTURE SUPPLY EXHAUSTED BY BOTH SOD AND GRAIN CROPS IN GREAT PLAINS

Soil-moisture records continuous on the same soils for periods up to 30 years have provided material for a study of the effect of cropping on subsoil water under dry-farming conditions. Under such conditions the soil within the zone of normal development of the roots of crops is usually dry at harvest time. Under continuous grain production there is an annual cycle of water accumulation and discharge. The water content of the soil builds up during the fall, winter, and spring until the rate of discharge by the rapidly growing crop exceeds the rate of recharge by precipitation. From that time on the water content of the soil decreases, and the discharge of available water is usually complete by the time the crop is mature. During the growing period the rate of recharge by precipitation very seldom exceeds the rate of discharge by the crop. The depth to which water penetrates depends on the quantity of precipitation and the character of the soil, but as a general rule the entire annual cycle of charge and discharge under continuous cropping is confined to the zone or only a portion of it in which roots develop freely, and no water reaches the underlying subsoil. Water charge and discharge are much the same under native sod as under continuous grain production, although available water may be removed completely to a lower depth under sod than under grain, because the native sod contains deep-rooted perennial plants.

The addition of fallow to the cropping system lengthens the period of water accumulation by a year and increases both the depth of soil that functions in the production of a crop and the number of times when water reaches the underlying subsoil.

Breaking up the sod in the Great Plains has not decreased the quantity of water in the subsoil. The subsoil is no drier, and generally is not so dry, under continuous grain production as under sod. Where fallow or a cultivated crop enters into the cropping system, the subsoil may be wetter than under sod. The net result of crop production in the semiarid region has been an increase rather than a decrease in subsoil water.

SPRING WHEAT FAILS WITH PRECIPITATION BELOW 10 INCHES

A study of the relations between annual precipitation and the yields of spring wheat in experiments conducted uniformly for 30 years in the Great Plains has established the lower limits of precipitation necessary to production, the approximate yield that may be expected from annual precipitation of any quantity, and the extent to which these yields may be modified by the use of such divergent practices as continuous cropping or alternate fallowing and cropping. In the northern Great Plains, the area to which spring wheat is adapted, a precipitation of only about 10 inches during the year ending July 31 usually results in generally near or complete failure of the wheat crop. Years with precipitation in excess of the quantity that can be utilized by the crop are too infrequent to determine satisfactorily the upper limits, but a precipitation of about 22 inches appears to be sufficient for maximum production. The use of such methods as continuous cropping to small grains, which annually exhaust the available water in the soil, results in the highest control of yields by the annual precipitation, whereas the use of methods such as summer fallow that store water in the soil in advance of the crop year reduces the dependence of the crop on the precipitation during that period.

DROUGHT-RESISTANT FRUIT VARIETIES

Data obtained in 1937 from the fruit variety tests at Mandan, N. Dak., continued to show the possibility of producing fruit for home use under dry-land conditions. Although trees and plants have suffered severely from the drought conditions of the last few years, many have survived and made a partial recovery in 1937. Improved varieties of native plums, sand cherries, Juneberries, and golden currants have been very drought-resistant and bore crops in 1937. Red Duchess and Oldenburg (Duchess) were outstanding apple varieties in 1937: but approximately 95 percent of the apple production was from crabs, of which Sylvia, Florence, and Alexis showed up well in quality and production. In the southern plains some varieties of grapes have shown a high degree of adaptation to drought conditions.

FORAGE CROPS AND DISEASES

P. V. CARDON, *in charge*

NEW ALFALFA STRAINS RESIST BACTERIAL WILT

Resistance of alfalfa to bacterial wilt (*Phytomonas insidiosa*), one of the most destructive diseases affecting this crop, has been increased by breeding and selection, and a few improved lines are, for all practical purposes, believed to be sufficiently resistant. Some of these lines, according to 1 year's results from 40 uniform nursery plantings made in 38 States in cooperation with State experiment stations, besides being highly resistant, appear to be more productive than commercial strains. Seed of resistant lines is being increased as rapidly as possible.

STRAWBERRY CLOVER TOLERATES TOXIC SALTS

Strawberry clover (*Trifolium fragiferum*) continued to show much promise as a leguminous crop for saline land, owing to its relatively high tolerance of toxic salts. High air temperatures tend to reduce, and low temperatures to increase, the degree of tolerance. Once established on saline soils, strawberry clover appears to be able to survive salt concentration, even though growth is retarded, and to resume normal growth when salt concentration is reduced. Strawberry clover was tested in 1937 in various Western States in cooperation with State experiment stations and other agencies concerned with forage production on saline land. The seed supply, which is still limited, is being increased as rapidly as possible.

COUMARIN CONTENT OF SWEETCLOVER VARIES WIDELY

The coumarin content of 2,500 individual sweetclover plants varied from 0.18 to 4.00 percent, showing a range of variation that should prove useful in selecting low-coumarin strains for the improvement of quality in sweetclover. The discovery of multiple-stemmed and late-maturing strains of sweetclover adapted to the Great Plains and the Corn Belt provides a basis for the development of better hay and pasture types for those regions.

NEW SOYBEAN VARIETIES SUCCEED IN SOUTH

Excellent results were obtained with some of the newly named varieties of soybeans distributed in 1937 in Southern States. The Palmetto, Clemson, Charlee, Nanda, Creole, and Georgian proved superior in yield of hay and seed to the commonly grown standard southern varieties.

CROP ROTATION REDUCES DISEASE LOSS IN FIELD PEAS

A study of field pea diseases undertaken in cooperation with the Georgia Experiment Station showed that several serious diseases are involved and that rotation is a likely means of control. In experimental plots and in field plantings it was observed that disease is least severe where field peas are grown on land not recently planted to this crop and is most severe where the crop has been grown continuously for a number of years.

GRASS-BREEDING PROGRAM ADVANCED IN ALL REGIONS

The season of 1937 was the second season of extensive grass improvement conducted in cooperation with State and Federal experiment stations in the major agricultural regions of the United States. Numerous native and introduced species assembled in nurseries afforded abundant material for determining the range of variability within individual species, the species of greatest promise within given regions, and the types of these species suitable for hay and pasture use. Up to this time the research work at these nurseries had been largely exploratory, but during 1937 research tended to become more concentrated with respect to those species in each region that are most likely to become the basis of grass-improvement activities.

HIGH TEMPERATURE REDUCES FOLIAGE AND ROOT GROWTH OF GRASSES

Grasses create for themselves an unfavorable condition by their rapid exhaustion of soil moisture during warm periods. Kentucky bluegrass, at Colum-

bia, Mo., when supplied with adequate moisture, produced relatively high yields of herbage during the spring and early summer at soil temperatures ranging from 54° to 70° F., but yields declined at 80°. However, herbage production did not rise to the spring levels during September and October when soil temperatures dropped to levels at which the higher yields had occurred in May and June. Early fall, during which herbage yields are relatively low, appears to be a period in which Kentucky bluegrass extends its roots and stores reserve food in its rhizomes.

Under controlled temperatures in a greenhouse, Kentucky bluegrass, and Canada bluegrass made maximum foliage growth at 90° F., orchard grass at 70°, and Bermuda grass at 100°. Kentucky bluegrass made its maximum root growth at 60°, Canada bluegrass at 50°, orchard grass at 60° to 70°, and Bermuda grass at 100°. Rhizome production of Kentucky bluegrass reached maximum at 60°, Canada bluegrass at 50°.

LENGTH OF DAY INFLUENCES SEED SETTING OF PLAINS GRASSES

Methods of inducing and increasing the production and viability of seed of Plains grasses were studied at Cheyenne, Wyo. Treatments involving various day lengths and night temperatures indicated that long days and warm temperatures favor the development of top growth of all species studied. There were indications also that *Andropogon furcatus* and *Panicum virgatum* bloom in short days, and that plants of *Bouteloua gracilis* bloom in any day length provided the temperature is high enough. Germination of seed of *Oryzopsis hymenoides* was increased from 0 to 75 percent by stratification and scarification. Plants growing in nutrient solutions of high osmotic pressure gave growth responses similar to plants growing in very dry soil, suggesting a handy technique in studying the drought-resistance mechanism of range grasses.

HEAD SMUT OF GRASSES CONFINED TO HOST SPECIES

With various methods of inoculation, at Pullman, Wash., 160 grasses, representing 60 species of *Agropyron, Bromus, Elymus, Hordeum, Lolium,* and *Sitanion,* were tested for susceptibility to *Ustilago bullata.* It was shown that collections of head smut from *Bromus* spp. are restricted to bromegrasses, and collections from *Agropyron* spp. and *Hordeum* spp. are incapable of infecting *Bromus* spp. Exhaustive inoculations showed that 7 collections of smut of *U. bullata hordei* represent at least 5 physiologic races and that 13 collections of *U. bullata bromi* represent at least 6 physiologic races.

GRASS SEED MAY BE HARVESTED BEFORE FULL MATURITY

Ten species of grass collected at Logan, Utah, at different stages of maturity and soil-germinated 4 months after collection showed high germination for most lots taken in the milk stage or later. Seed collected before the milk stage gave lower germination and produced inferior seedlings. These results indicate that seed of these species may be harvested safely before full maturity, thus avoiding losses due to shattering.

IMPROVED PASTURE MANAGEMENT FOR COASTAL PLAIN

Turning or stirring the soil once in 3 years is necessary to maintain a good Bermuda grass pasture on the Coastal Plain, according to the results of experiments at Tifton, Ga. Where lespedeza is included in the pasture the turning should be done about March 1, before lespedeza seeds have sprouted. Turning the land delays grazing in the spring, so it may be advisable to turn a part of the pasture each year instead of turning the whole pasture every third year. Turning *Digitaria* spp. destroys the sod, hence renovation should be confined to stirring. Kudzu may be grazed continuously provided it is not overgrazed. Napier grass grows well on the Coastal Plain and is highly palatable, but it suffers in competition with weeds. It is possibly of greater use in dairy than in beef-cattle pastures. Woolly fingergrass continues to give excellent results as grazing for beef cattle, but a cultural practice must be evolved for keeping a good sod. Phosphate fertilizers appear to be necessary on lowland pastures where white clover is included. On upland permanent pastures fertilizers have increased beef-cattle gains, but whether economically or not remains to be determined. Abruzzi rye or oats make good temporary winter pastures. Ryegrass has not been satisfactory for winter grazing on ordinary

farm land. Common lespedeza is an excellent temporary summer pasture from July 1 to frost if moisture conditions are favorable. Ototan soybeans, cattail millet, and velvetbeans have given best summer temporary grazing.

KOREAN LESPEDEZA PROFITABLE SUPPLEMENT FOR BLUEGRASS PASTURE

The importance of maintaining a pasture of Korean lespedeza to supplement Kentucky bluegrass in midsummer was emphasized by the results of a grazing experiment at Grain Valley, Mo. Thirty steers were pastured on 2 acres of Korean lespedeza for 8 weeks. At the end of the grazing period the cattle on Korean lespedeza pasture graded one grade higher than those that continued on bluegrass during the same period, and the cattle on the supplemental pasture produced 38 percent greater live-weight gain.

REESTABLISHING OR IMPROVING GRASS COVER IN SOUTHERN PLAINS

Methods of reestablishing pasture and range grasses on cultivated land in the southern Great Plains at Woodward, Okla., showed that the stubble of a preceding crop of Sudan grass or sorghum was ideal in controlling soil blowing, which control is necessary for grass establishment in this region. Sudan grass or sorghum sown in close drills the preceding year and harvested for hay so that an 8- or 10-inch stubble remains for protection furnishes a desirable seedbed. A combination of drilling and broadcasting the grass seed in the stubble appears most promising in obtaining a uniform stand. Grass stands have been improved in thin pastures by broadcasting the cured hay of native grasses that contains matured seed. This method is quite economical and is adapted to the region, since stands of native grasses allowed to ripen seed may be harvested from meadows, roadsides, or pastures when grazing has been deferred.

FOREST PATHOLOGY

HAVEN METCALF, *in charge*

RUSTS DAMAGE YOUNG SOUTHERN PINES

During 1937 the native gall-forming rusts of southern pines, formerly considered of minor significance, were found on either slash or loblolly pine seedlings in 7 of the 10 southern forest nurseries surveyed. Plantation trees with rust cankers resulting from nursery infections were found in Louisiana, Mississippi, and Georgia. Trees in plantations as well as in young natural stands were also infected by spores produced on nearby scrub oaks, which the causal fungi require as alternate hosts. The damage in some plantations has already reached disturbing proportions. A general survey to evaluate the danger has been started with the aid of the Civilian Conservation Corps. A beginning has already been made in protecting planting stock from the rusts by spraying nursery beds or by eradicating oaks near nurseries, and the possibilities of decreasing infection sources near plantations are being explored.

Formerly the distribution of these rusts was ecologically controlled. On the original longleaf pine areas the disease was not economically important because of the comparative resistance of the longleaf pine and the relatively small amount of oak foliage. In recent times logging has opened up the stands, and this together with fire control has allowed increase of the oaks and of the susceptible slash and loblolly pines. Slash pine particularly has also been used in extensive artificial reforestation as a result of the recognition of the favorable economic and environmental conditions for profitable timber growing in the Gulf region. The unexpected result has been a development of the rust that is causing alarm and may call for change in management plans.

DUTCH ELM DISEASE SPORES CARRIED IN TREE SAP

Progress has been made in determining some of the factors affecting the pathology of the Dutch elm disease. It has been found that the spread of the parasite in the tree is largely by spores carried in the sap stream in the water-conducting vessels. Movement of spores may be extensive and rapid in the ring of large, long, spring vessels, but is more restricted in the smaller, shorter, summerwood vessels. Spores of *Ceratostomella ulmi* injected at the base of 50- to 60-foot elms have been recovered from the tops within a few hours. Rapid downward movement of the spores in the large water-conducting vessels has also been demonstrated.

NECTRIA CANKER IN RELATION TO STAND OBJECTIVE AND MANAGEMENT

Investigations on the nectria disease complex were undertaken to obtain information as a basis for sound methods of handling cankered trees in conjunction with stand-improvement work. A distinct strain of *Nectria* causes the canker on yellow poplar. Observations on nectria-cankered yellow poplars released by thinning 3 years ago indicate that vigorous trees of this species will heal the cankers, but that suppressed trees are likely to be girdled by them. The strains of *Nectria* occurring on several species in the Northeast have been found to be cross-inoculable. It is not practicable to attempt eradication, but species and trees on which infection is most common can be discriminated against. At the same time preference can be given to the well-formed, vigorous trees, which may effectively check invasion of the fungus. The conversion of heavily cankered hardwood stands to softwoods by either planting or release cuttings may be practicable and desirable in some areas. On areas on which game conservation, watershed protection, and recreation are the primary considerations, nectria canker is of little importance.

AIR CURRENTS SOMETIMES CARRY WHITE-PINE BLISTER RUST SPORES LONG DISTANCES

Analysis of the Pacific coast upper-air records of the United States Weather Bureau with special reference to opportunities for the southward transmission of white-pine blister rust spores indicated that favorable periods for the long-distance carriage of spores into the sugar pine section of California are infrequent, and that, when they do occur, they are not always followed by conditions suitable for infection. A favorable sequence of winds and moisture in the late spring of 1937 resulted in the first general infection of ribes (the alternate hosts of the white-pine blister rust fungus) in the northern end of California and extended the known limits of the rust in that region approximately 120 miles southward. Infections were found over a front 65 miles wide, indicating a fairly distant source for the spores.

HEARTWOOD OF WIND-THROWN DOUGLAS FIR AND WESTERN RED CEDAR RESISTS DECAY

A violent windstorm on the Olympic Peninsula in January 1921 blew down approximately 5 billion board feet of timber—windfall without a known parallel. Examinations of some of this timber have been made periodically to determine the rate of decay in the various species with special reference to the practicability of salvage operations. Western hemlock and silver fir were completely unmerchantable within a few years after the blow-down. The smaller Sitka spruces deteriorated almost as rapidly, but in 1936 the larger logs of this species still contained sound cores of sufficient volume to justify salvage. Sapwood of Douglas fir and western red cedar became unmerchantable soon after the blow-down, but heartwood of Douglas fir is still largely sound and that of western red cedar practically unaffected by decay. The abundant precipitation and high humidity of this section, together with the dense vegetative cover on areas cleared by the storm, have caused the down material to become and remain almost completely saturated. The progress of decay has been materially retarded by the increase in moisture content of the wood, and it therefore seems probable that Douglas fir heartwood will suffer very little further deterioration for some time to come. The highly durable heartwood of western red cedar may be expected to remain sound almost indefinitely.

FRUIT AND VEGETABLE CROPS AND DISEASES

H. P. Gould, *in charge*

NEW PEACHES REQUIRE LESS COLD TO BREAK REST PERIOD

In southern peach-producing regions the winter cold may sometimes be insufficient to cause normal breaking of the rest period of certain commercial varieties. This condition results in delayed and irregular development of blossoms and leaves. Crosses with two peach introductions from South Africa have produced hybrid varieties that require distinctly less cold to break the winter rest period.

This work gives promise of breeding varieties better adapted for growing in regions where mild winters occur. A number of chemicals have been used as sprays in the study of methods of breaking the rest period, and there is a prospect that some of these may be used effectively in regulating the breaking of winter dormancy and the time of blooming of peach varieties.

ADDITIONAL NEMATODE-RESISTANT PEACH ROOTSTOCKS

Nematode resistance has been previously found in two very promising peach rootstocks, Shalil and a hybrid from Quetta nectarine × Bolivian Cling peach. In tests during the last 4 years another peach variety known as Purple Leaf has shown complete immunity from nematode attack in the parent trees and in a large planting of 1-year seedlings. Other valuable characters of Purple Leaf for rootstock purposes are vigor of growth, early bearing, heavy production of small freestone peaches, and high percentage of seed germination.

FREQUENT SPRAYING CONTROLS LEAF SPOT DAMAGE TO DEWBERRY

In spraying experiments to protect Lucretia dewberry foliage against infection by leaf-spot fungi there was a 60-percent increase of berry production on plots sprayed five times the previous season with bordeaux mixture for foliage protection, as compared with a slight increase on plots sprayed only during the current season. Records of leaf spot infections indicated that spring applications were highly effective in reducing development of leaf spots even as late as the year following. This result indicates the importance of keeping dewberry foliage in healthy condition during the whole growing season in order to insure a good crop and freedom from infection the following year.

HARDY FRUIT VARIETIES ADAPTED TO HIGH ALTITUDES

Definite progress has been made in finding hardy fruit varieties adapted for growing at high altitudes under the severe climatic conditions of the central Great Plains area. Several varieties of grapes have proved to be early enough to ripen fruit. The Red Lake variety of currant has been outstanding in all tests. The Chief variety of raspberry seems to be the hardiest and uniformly outyields all others in the northern part of this area. The first fruiting of plum test plantings indicates some promising varieties. Apparently no sufficiently hardy strawberry exists in the trade, and the most promising commercial types are being crossed with hardy native species. In all of the fruit testing in this project the purpose is to assemble promising stocks both of horticultural varieties and of hardy native species, and to use these in selection and breeding work to develop new varieties especially adapted for cultivation in the region.

SCAB-RESISTANT TANGELO VARIETIES DEVELOPED

Tests under orchard conditions in Florida and Texas indicate that three tangelos developed in breeding work are highly scab-resistant and satisfactory in dessert and shipping quality. These varieties are Orlando (early), Seminole (midseason), and Umatilla (late). The Orlando, because of its early maturity, is receiving most attention from growers. Tangelos are hybrids between the tangerine and the grapefruit (or pomelo), both of which are susceptible to scab. The first varieties of tangelos introduced some years ago were of high quality but very susceptible to scab, and this defect was a drawback to their general cultivation. These new varieties meet a need for tangelos better suited for economical commercial production.

CHEMICAL TREATMENTS INCREASE PINEAPPLE YIELDS

In preliminary studies in Florida it was found that spraying pineapple plants with 6-percent ferrous sulphate solution gave an increase of about 50 percent in fruit production even with acid-forming commercial fertilizer applications that seemed to be optimum for yield. On other plots the addition of magnesium sulphate to the soil gave a corresponding increase in yield beyond the apparent fertilizer maximum. The addition of borax to the soil gave about 25-percent increase in yield, but borax was deleterious when applied as a spray. Zinc sulphate showed no beneficial effect.

SPRAYING CONTROLS MANGO ANTHRACNOSE

Investigations on control of mango anthracnose have shown that a dormant application of bordeaux mixture is especially important in preventing bloom blight or early establishment of the fungus in the bloom clusters. Omission of this dormant spray resulted in a 50-percent increase of diseased fruits in spite of four applications during the period of blooming and young fruit development. In addition to preventing anthracnose spotting of fruits during their development, the full early coverage spraying program retarded spot development after the fruit was harvested and definitely prolonged the market life of the fruit.

PROPER BORDEAUX SPRAY REDUCES DAMAGE TO WALNUT LEAVES

Under severe epidemic conditions prevalent in 1937, walnut bacterial blight was well controlled by three applications of bordeaux mixture, beginning in the early prebloom stage. Injury to young walnut foliage sometimes follows the application of 2–2–50 bordeaux mixture, but may be reduced, in most cases to an insignificant amount, by the addition of fish (salmon) oil or certain oil emulsions to the bordeaux mixture at the rate of 1 pint to 100 gallons of spray. The severity of foliage injury diminishes with decreasing amounts of lime in the bordeaux mixture down to the neutral point. High-magnesium lime is not so injurious as high-calcium lime in the 2–2–50 formula. There was no evidence of premature defoliation of walnut trees after spraying with a proper bordeaux mixture, and the nuts were not appreciably affected in size or weight.

PECAN TREES REQUIRE ZINC

Continued investigations confirm the importance of zinc for optimum pecan-tree growth. This is evidenced by its consistent correction of the pecan rosette disease, by the reduced amount of foliage burn on trees fertilized or sprayed with zinc sulphate, and by the deeper green color, aside from reduced burning, of the foliage of zinc-treated trees.

BABY FORDHOOK LIMA BEAN RELEASED TO GROWERS

Small quantities of the new lima bean variety named Baby Fordhook have been released to seed growers and investigators. This is a new type of small, thick-seeded lima, of bush habit, comparable with Henderson bush lima in season and yield, but more attractive and of better quality.

IMPERIAL NO. 44 HEAD LETTUCE WELL ADAPTED TO NEW YORK

Imperial No. 44, a new head-lettuce strain especially adapted for growing in New York, has been released by the Department for commercial use at the insistance of New York investigators and growers who have tested the stock extensively. It has given good results in small trials in other Eastern States as well. In the Pacific coast region, where this strain was originated, it usually makes heads too small to meet market standards.

PEA VARIETIES RESISTANT TO MOSAIC VIRUSES

Studies on the identification and classification of four new pea-mosaic viruses show that they are distinct types. Two of these viruses are more destructive on peas than any pea virus thus far described. Several varieties of peas have proved to be immune to all of them and offer excellent parental material for the development of mosaic-resistant strains. The host range includes a considerable number of leguminous garden and field crops.

NEW TOMATO HYBRIDS NEARLY IMMUNE TO FUSARIUM WILT

Several lines of the small Currant tomato are apparently immune to fusarium wilt. When crossed with standard tomato varieties they have given hybrid progenies that are more highly resistant to fusarium wilt than varieties previously developed. First- and second-generation hybrids between Currant and 100-percent susceptible Bonny Best show almost complete immunity. Some of the hybrids between Currant and resistant Marglobe backcrossed twice to Marglobe seem to be satisfactory in production and size of fruit as well as in wilt resistance.

PREPLANTING TREATMENT BREAKS DORMANCY OF LETTUCE SEED

A preplanting treatment has been devised to break the dormancy and insure prompt germination of seed of those lettuce varieties that typically produce "dormant" seed. Seed dried carefully after the treatment germinates satisfactorily if planted within 2 or 3 weeks. The treatment requires that the dormant seed be held for a few hours under suitable conditions of moisture, temperature, light, and aeration until the germination process has begun, and then the activities associated with germination must be arrested by very slow drying of the seed in darkness at 45° to 50° F.

NEW SWEETPOTATO VARIETIES PROMISING FOR STARCH PRODUCTION

Two new seedling sweetpotato varieties selected from populations grown from open-pollinated seed obtained in Cuba are attracting much attention for their probable value in starch manufacture. They yield heavily and have high starch content and remarkably white flesh. Three introductions, two of which have been under test for some years, are also of exceptional promise. Commercial quantities of these varieties have been grown only in the vicinity of Laurel, Miss., in connection with experiments in starch production.

SELECTED SEEDLINGS OF STOCK (MATTHIOLA) PRODUCE MOSTLY DOUBLE FLOWERS

When florists grow the double-flowered stock (*Matthiola*) there is always a large proportion of single-flowered plants that are unsalable, usually amounting to much more than half the crop. Breeding investigations have shown that even the best parent matthiolas transmit the character of doubleness to but slightly over 50 percent of the seedling offspring, but that the seedlings destined to produce double flowers are more vigorous in very early growth and produce notched leaves earlier than the singles. By planting seed for about two and one-half times the requirement, and by selecting from these the largest plants showing the first notched leaves, stopping when about 40 percent of the population has been selected, it has been possible to obtain averages of over 96 percent double-flowered plants.

GROWTH-PROMOTING SUBSTANCES STIMULATE ROOTING OF CUTTINGS

Tests were carried out with cuttings of more than 100 species of woody fruit and ornamental plants to determine the effectiveness of growth-promoting substances in stimulating root formation and their practical value in nursery propagation. Various concentrations of solution and periods of treatment were used. For about half of the species the time necessary to form roots was shortened by a few days to more than a month. Some of the species in which the time of rooting was only slightly shortened formed roots more abundantly. From a practical point of view a real gain was made in about 10 species, which rooted in fair percentages after treatment but failed to root without it. Other difficult-to-root species tested gave no favorable response to any of the treatments. The most beneficial effects were obtained when cuttings were taken at the best stage of growth for rooting in the normal way. The roots induced by the treatment developed normal plants, but no gain was observed in their subsequent growth over normal cuttings, even when the latter carried fewer roots. While these results show that the treatment has certain advantages for some species, the real gains seem quite modest in comparison with claims that have sometimes been made.

It is difficult to propagate chestnut varieties by bench grafting because of slow root growth after the grafted plants are set out. Whip or tongue grafting of seedlings in the nursery row results in unsatisfactory unions in a large number of cases. The budding of chestnut nursery stock is more successful, especially when parafilm is used as a wrap; but good budwood is difficult to obtain in the case of certain chestnut types that form buds sparingly on the lower part of the current season's shoots. Treatment of chestnut root cuttings with growth-promoting substances has caused them to form roots satisfactorily and offers what seems to be a practical solution of the problem of rapid propagation of superior chestnut hybrids and selections in breeding investigations and in regular nursery practice.

NEW POTATO VARIETIES DEVELOPED

Two new potato seedlings have continued to yield well in trials in a number of locations. They have been named Sebago and Earlaine, and seed stock has been increased for distribution. Sebago is resistant to late blight in both vines and tuber. Earlaine is as early as Irish Cobbler and produces tubers with higher market quality. Among previous introductions Katahdin and Chippewa are increasing in popularity each year, and Houma is attracting considerable attention from potato growers in several States. From recent crosses seedlings have been obtained that combine resistance to several diseases with high yield and superior quality, and the prospect is that a number of these will attain variety status in the next few years.

KATAHDIN POTATO RESISTANT TO MILD MOSAIC

Attempted experimental infection of the Katahdin potato with mild mosaic virus shows that the infective aphids during feeding actually contact the phloem tissue of this variety with the same frequency as other varieties that contract the disease. It is in phloem that the virus spreads. The resistance of Katahdin to mild mosaic therefore seems to depend on some inherent inhibitory property of the plant substance rather than on a more or less accidental failure of the virus to reach the exact tissues that are affected in ordinary varieties. This finding increases confidence in the ability of Katahdin to resist the aphid-borne mild mosaic under general field exposure. In the breeding work it has been found that mild mosaic resistance of the parent lines is transmitted to the great majority of their progeny.

BARTLETT PEAR STORAGE PERIOD PROLONGED BY CARBON DIOXIDE TREATMENT

It has been found that when Bartlett pears are exposed to atmospheres of 20-percent carbon dioxide gas for 10 days under simulated transit conditions their ripening processes are greatly delayed when they are held subsequently in cold storage. Such gas treatment at 65° F. increased by 30 days the potential storage life of the fruit held at 32°, and similar treatment at 45° added more than 40 days to the cold-storage life of the fruit. The 10-day carbon dioxide gas storage at 45° was as efficient as immediate storage at 32° in delaying ripening processes. Progress is being made in devising methods for maintaining the requisite concentration of carbon dioxide in cars in actual transit.

PROPER LOADING REDUCES INJURY TO POTATOES IN TRANSIT

Freezing of potatoes in winter shipments from northern points is partly due to loading the potatoes only slightly above the freezing point and to the entrance of very cold air into the car while loading. The use of sacks 2 inches shorter and correspondingly wider gives an air space of about 3 inches between the load and the car wall, which prevents direct conduction of heat from the potatoes through the car walls and also prevents chafing of the sacks. A 16-inch electric fan insures more effective preheating of the loaded car and reduces the required time from about 18 to about 3 hours. Satisfactory results have been obtained in adapting a portable thermostatically controlled charcoal heater and a permanently installed underslung gas heating system for protection of potato shipments.

Investigations of injuries to potatoes loaded next to the car floor show that the primary cause is usually bruising against the floor as a result of load pressure and car movement. Sometimes there may be complications from freezing or injury by chemicals, such as salt or fertilizer, left on the car floor. Potatoes at 32° F. received more bruising injury than those at 50° under similar loading conditions. When freezing was produced along with floor bruising, the symptoms of freezing occurred in unbruised as well as bruised tubers. Under experimental conditions potatoes were not injured by chemicals likely to be found on the floor of railroad cars unless tubers next to the floor were so bruised as to break the skins and exude enough juice to wet soluble chemicals.

STORAGE SCALD OF LIMES PREVENTED BY TEMPERATURE CONTROL

Storage scald of Florida-grown Persian limes was severe at 41° F. but practically negligible at 45° and 48°. Some reduction in scald resulted from moving fruit from 41° to 58° for 1 day at intervals of 2 weeks. Waxing the limes or exposing them to carbon dioxide before storing at low temperatures tended to increase scald.

CRANBERRY STORAGE BEST AT TEMPERATURE OF 36° F.

The most satisfactory cold-storage temperature for New Jersey-grown Early Black and Howes varieties of cranberries was found to be 36° F. At lower temperatures there was considerable low-temperature break-down during a storage period of 2 to 4 months. At higher temperatures color development progressed beyond the most desirable trade requirement and there was an increase in decay. Cranberries harvested when half colored developed less decay and a more desirable color during storage at 36° than did berries that were fully colored at harvesting. The Howes variety has proved more satisfactory than Early Black for cold storage.

MYCOLOGY AND DISEASE SURVEY

H. A. Edson, *in charge*

MYCOLOGICAL SPECIMENS TOTAL NEARLY 400,000

The mycological collections of the Bureau, including associated units, now total 384,550 specimens, an increase for the year of over 8,000. New additions consist of standard exsiccati series as issued, exchange material, specimens sent by a wide range of correspondents for identification, and deposits by workers from this and other bureaus and many other sources. Supporting fungus and literature indexes have been maintained.

FUNGI ATTACK CLOVER ROOT CURCULIO AND CORN EARWORM

In collaboration with the Bureau of Entomology and Plant Quarantine, life-history studies of fungi attacking the clover root curculio and the corn earworm have been carried to completion and the fungi involved named and described. Series of Discomycetes or cup fungi from the Hawaiian Islands, Central America, and the District of Columbia area have been named for correspondents or as a step in the preparation of regional floras.

PLANT DISEASE REPORTER KEEPS PLANT PATHOLOGISTS INFORMED

Publication of current information on plant-disease incidence in the United States in the mimeographed Plant Disease Reporter has been continued. This informal publication, issued twice a month, supplies promptly to research and extension workers current information of special value in the control and prevention of plant diseases.

NEMATOLOGY

G. Steiner, *in charge*

WHEAT NEMATODES IN GALLS ALIVE AFTER 16 YEARS

In the laboratory at Salt Lake City, Utah, tests are being made with nematode-infested wheat kernels (galls) stored there. From time to time these galls are checked as to the viability of the nematodes they contain. Such a recent check proved this species will revive 100 percent after a dormancy of 16 years. Similar tests with other nematode species raised to 10 years the possible length of dormancy for the bulb or stem nematode infesting teasel.

CERTAIN GARDENIAS AND MARIGOLDS RESIST ROOT KNOT NEMATODE

Experiments of the last 2 years confirm the claim that *Gardenia thunbergi* offers some opportunities to growers troubled with the root knot nematode. However, contrary to some statements, it is not immune to this pest. The roots

are attacked, but to a decidedly less degree than either the common or some other gardenias. Root tips are usually not blinded, the galls are small (the uninformed may overlook them), the root cortex generally is not split wide open by the nematode, and the growth of the root system appears normal and healthy, in decided contrast to the stunted and sickly appearance of an infested plant of the common kind. *Gardenia thunbergi* therefore may be planted to advantage in regions generally infested with the root knot nematode or may be used as an understock for the more susceptible forms.

In similar tests with 29 varieties of marigolds the roots of all of them were attacked, least in the African varieties (*Tagetes erecta*), more heavily in the French varieties (*T. patula*). Many African varieties had only few and small galls, the roots appearing quite tolerant to the infestations, and the root systems of normal growth.

The claims made of a resistance to the root knot nematode in zinnias seem to be disproved by recent experiments. Of 37 varieties of zinnias, nearly all were heavily infested and no consistent resistance was observed.

MANY STRAINS OF BUD AND LEAF NEMATODE ARE FOUND

There are numerous physiological strains of the bud and leaf nematode, *Aphelenchoides fragariae*, differing in their behavior but very similar morphologically. Many authors consider some of them still as different species (*A. ritzemabosi, A. olesistus, A. subtenuis*). The extent to which these are host specific is a matter of importance not only in proposing control measures but in formulating effective quarantine regulations. Recent experiments indicate that these strains, although not highly host specific, are restricted nevertheless in their host range. In some plants—begonias, soybeans, and Sudan grass, for example—an experimental infestation with several strains can be established, but with those strains not normal to the plant the infestation persists for a few months and appears to be temporary. In chrysanthemums, on the other hand, only the chrysanthemum strain has been experimentally established. Some strains normally infesting the buds of their host plant may be established experimentally in the tissues of certain leaves and vice versa, but the permanence of such infestations is questionable.

PLANT EXPLORATION AND INTRODUCTION

B. Y. Morrison, *in charge*

SELECTIONS PROMISE DISEASE RESISTANCE IN HEVEA

From pollination experiments in connection with a study of breeding for disease resistance in *Hevea* was obtained a collection of seeds that are probably the first controlled hybrid seeds ever produced with this type of breeding program in mind. This is probably the first step in understanding the real problems involved in the South American leaf disease that is usually considered the limiting factor of commercial production of rubber.

NATIONAL ARBORETUM SITE IMPROVED

An important accomplishment for the development of the National Arboretum was the purchase of several small parcels of land abutting the former holdings. Until these parcels were acquired they constituted a serious problem in the general development, since they provided opportunity for the location of small businesses and shops almost within the Arboretum property.

TAXONOMIC SERVICES EXTENDED

A taxonomic monograph of all citrus and their relatives, recently completed, is expected to serve as the basis of future studies on citrus and to furnish clues for horticultural problems of breeding and stocks. This text undertakes to clarify certain obscure relationships and to reorganize and realign certain groups now improperly grouped. It affords an example of what a taxonomic study of a cultivated plant and its wild relatives can do for the geneticist and the horticulturist.

NEW INTRODUCTIONS FOR VEGETABLE BREEDING

Vegetable breeding problems are of essential interest in almost every part of the United States, whether they relate to disease resistance, improvement of quality, or change or extension of season. Toward this end, over 1,800 lots of seed particularly related to the Government program in vegetable breeding were brought in. Nearly all of the staple vegetable crops were included, but particular attention was given to the group that includes squash, melons, cucumbers, and pumpkins, to wild tomatoes and their allies, to onions and their allies, and to spinach. The cucurbits and tomatoes serve largely as the basis of breeding experiments in other divisions of the Bureau and for special projects in several State experiment stations.

SEED INVESTIGATIONS

EDGAR BROWN, *in charge*

OFFICIAL CERTIFICATE REQUIRED FOR STAIN DESIGNATING CANADIAN RED CLOVER SEED

Importations of seed of alfalfa and red clover in the fiscal year 1938 were comparable to those of 1937, and importations of seeds of other forage plants continued to be large. Samples of these importations were examined for origin and tested for purity and germination, the staining color was designated, and supervision of the staining of the seed was provided.

An amendment to the joint regulations of the Secretary of the Treasury and the Secretary of Agriculture under the Federal Seed Act became effective March 8, 1938. This amendment provides that no red clover seed will be designated for 1-percent iridescent violet coloring unless the shipment is accompanied by a Canadian Government official certificate to the effect that the seed was produced in Canada.

GERMINATION TEST INDICATES CONDITION OF STORED GRAIN

More than 1,500 samples have been tested for germination in connection with the cooperative grain-storage project conducted under a Bankhead-Jones special research fund. Changes in germination ability of stored grain has been found to be a delicate measure of the progress of deterioration during storage.

The rate of loss of viability of seeds of various crop plants is being studied in relation to moisture of the seed and temperature of storage. Work is also in progress on the germination requirements of the seeds of some of the native western range plants as well as of certain weed seeds.

SOIL FERTILITY INVESTIGATIONS

OSWALD SCHREINER, *in charge*

NEW COMPOUNDS TESTED FOR FERTILIZER VALUE

During the year cooperative research was conducted to determine whether certain compounds proposed for fertilizer use possessed plant-use value. The studies showed that certain of them, including melamine and guanidine compounds, were unsatisfactory as fertilizers. Other compounds, including potassium metaphosphate, monocalcium chlorphosphate, and calcined phosphate, were found to be equally as good as standard materials. New chemical products of the Tennessee Valley Authority have been compared with standard fertilizer materials. It has been determined through greenhouse and field studies that calcium metaphosphate, made by treating phosphate rock with the hot reaction products of burning phosphorus, and which contains as much as 65 percent of phosphoric acid, is as efficient as ordinary superphosphate as a source of phosphorus for plants. Its high concentration makes it a good constituent of concentrated fertilizers. Other T. V. A. products tested include fused phosphate rock, dicalcium phosphate, treble calcium-magnesium phosphate, and treble superphosphate, all of which have been shown to be worth-while fertilizer materials.

EFFICIENCY OF SOLUBLE NITROGEN INCREASED IN NONACID-FORMING FERTILIZERS

The fertilizer investigations with cotton soils have recently brought out an important new fact, that when fertilizers are made nonacid-forming by the use of limestones supplying magnesium and calcium, the cheaper soluble organic and inorganic sources of nitrogen are as efficient on many soils as the more expensive natural organic sources. Moreover, in such cases all the fertilizer may be applied at planting time, thus further reducing production costs. The use of the more highly concentrated fertilizers containing soluble nitrogen, which have been shown to be suitable for cotton soils, will result in large savings for cotton growers.

In studies pertaining to the nutrition of cotton when fertilized with acid-forming and nonacid-forming fertilizers, it has been found that increasing the potash content of an acid fertilizer decreased the calcium content of the plant, whereas increasing the potash content of neutral fertilizer increased the calcium content of the plant. The increase of the potash content of the plant was in proportion to the potash added in an acid fertilizer and was more pronounced than where the fertilizer was neutralized.

ORGANIC PHOSPHATES ARE READILY AVAILABLE TO PLANTS

The marked advantage of nucleic acid when employed as a source of nitrogen and phosphorus in soil cultures has been found to be due largely to its content of organically combined phosphoric acid. Other organic phosphates not available from commercial sources have been synthesized in the laboratory. Greenhouse experiments have demonstrated an advantage of these organic phosphates as sources of phosphorus for plants under soil conditions where soluble inorganic phosphates are rapidly fixed in unavailable forms. Organic phosphates in the form of yeast nucleic acid, glycerophosphate, mannityl phosphate, glycol phosphate, and the like, in which phosphoric acid is combined with an organic substance, maintain the available phosphorus at a level enhancing the growth rate of the crop.

SOIL MICROBIOLOGY

CHARLES THOM, *in charge*

DRY LEGUME INOCULATION NOT SATISFACTORY

Nodule bacteria for inoculating legumes are usually suspended in water and applied to the seed before planting. Recently, however, a method has been proposed in which the water is eliminated, the bacteria being carried in a dry, powdery material. Field comparisons of inoculants for wet and dry application on Austrian Winter peas and soybeans have shown that the dry inoculants frequently produce unsatisfactory crop responses, whereas inoculants that include water in the treatments have given excellent results. In accordance with these findings, manufacturers of inoculants for dry application have modified their carrying media and have changed their directions to include the use of water in the treatments.

AMOEBOID ORGANISMS DESTROY OTHER MICRO-ORGANISMS IN SOIL

The studies of *Dictyostelium* in its relation to substrata and to species of bacteria important in the soil have been completed and submitted for publication. The amoeboid phase of the slime molds had already been shown to be abundant in the soil. Their selective ability to destroy other micro-organisms is now shown to be so great that further studies of their distribution in the field and the relation of that distribution to soil-population problems are indicated.

SUGAR PLANT INVESTIGATIONS

E. W. BRANDES, *in charge*

COLD-RESISTANT SUGARCANES DISCOVERED

Further stabilization of sugarcane yields through greater cold resistance has been given special attention. Some progress has been made and is reflected in the small loss in commercial fields, estimated at 10 percent, following a range of temperatures in various parts of the cane belt of 22° to 29° F. on November 21,

and 18° to 26° on December 7, 1937. Similar temperatures would have caused excessive loss in the varieties formerly grown in Louisiana. Although damage by cold is not frequent in Louisiana and Florida, freezing weather is an ever-present menace. A cold-resistant wild sugarcane discovered at latitude 40° north in Turkistan and other collections made in central and anterior Asia were successfully established at the Arlington Experiment Farm (Virginia) in late September. Overwintered in the field, the plants were injured but not killed by a low temperature of 11.5° lasting for 2 hours on January 19, 1938. This remarkable tolerance of cold encourages the belief that commercial varieties more resistant to cold may be developed by breeding.

SUGARCANE VARIETIES THAT RESIST INVERSION DISCOVERED

In addition to the outstanding resistance of variety C. P. 29/137 to inversion of sucrose when windrowed, nine other seedlings have been found promising in that respect. Data were obtained on the relative resistance to inversion of sucrose of different commercial varieties after freezing temperatures and of the influence upon keeping quality of the percentage of eyes remaining alive. It was found that, when stored at temperatures ranging from 50° to 80° F., cane of Co. 290 and Co. 281 in which 37 to 38 percent of the eyes remained sound showed no abnormal changes during 2 weeks' storage, whereas cane in which no eyes remained sound began to deteriorate in 6 days. Such data are of value in determining the extent to which cane should be windrowed after freezing temperatures. Discovery that, within certain limits, increase of temperature at which sugarcane is stored does not increase the rate of inversion of sucrose and may have the opposite effect is an unexpected result of value in guiding commercial practice.

SUGAR-BEET PRODUCTION REVIVED WITH CURLY TOP RESISTANT VARIETIES

The record of breeding work of the Division lists a succession of sugar-beet varieties resistant to curly top that have been introduced for commercial use since 1933, namely, U. S. 1, U. S. 34, and U. S. 33, which, with resistant varieties from other sources, have shown steady increase in adaptability. Their use has removed much of the danger that formerly threatened the destruction of the beet-sugar industry in parts of California, western Colorado, Idaho, and Utah. The industry in these States has been revived and stabilized. Sugar-beet growing has been resumed on a large scale in areas in California, Idaho, Oregon, and Washington from which curly top earlier drove it out. A beet-sugar factory was built in the Yakima Valley of Washington at Toppenish in 1937 on the site of a factory abandoned in 1924. At Nyssa, Oreg., a plant is under construction to serve western Idaho and eastern Oregon. Near Delta, Utah, where a beet-sugar factory was abandoned in 1924, several fields were successfully grown in 1937 and the acreage was expanded in 1938. In the San Joaquin Valley of California, where two factories earlier failed, an extensive acreage was planted in 1937, and in 1938 plantings were increased. This record of reestablishment of sugar-beet growing in areas in which crop failure was brought about by curly top gives striking evidence of the progress made toward developing safe strains.

The most recently introduced improved variety, U. S. 12, has higher curly top resistance than previous Federal introductions and, under extreme exposure in 1936, yielded an average of 20.18 tons, while a susceptible variety yielded only 3.05 tons. The variety was obtained as a direct selection of 33 extremely resistant plants out of U. S. 1. Seed production of this variety amounted to more than 2,551,000 pounds for planting in 1938. Fields in the curly top area not planted with U. S. 12 have been largely planted with U. S. 33, a variety slightly lower in curly top resistance but slightly richer in sucrose. Now that U. S. 12 and U. S. 33 have reached the dominant position for the major part of the 280,000 acres in the curly top area and probably will be found reasonably well adapted, their replacement with new varieties may be slower.

NONBOLTING VARIETIES OF SUGAR BEETS DEVELOPED

The complicated problems that arose in California incident to the winter planting of sugar beets, and the bolting of all but the more refractory individuals, are rapidly being met by the plant breeder in producing nonbolting varieties that have special adaptation to the California conditions. The cool, moist growing conditions of coastal areas in California have brought to the foreground the

injury caused by downy mildew (*Peronospora schachtii*), and curly top resistant varieties that are both nonbolting and downy-mildew resistant (notably U. S. 15) have been found and are under preliminary evaluation test.

DAMPING-OFF REDUCED WHEN SUGAR BEETS FOLLOW GRAIN CROPS

Continued tests in field and greenhouse have demonstrated that corn and to some extent small grains reduce the pathogene content of soils, so that stands of sugar beets are improved when these cereals are the preceding crops. Certain weeds, notably red root pigweed, which often grows in dense stands in neglected fields, have been found to act as hosts of the damping-off pathogenes and lead to serious effects on stands when sugar beets are planted the following year in such weedy fields. Previous observation has indicated superior results when the beet crop follows clean-cultivated crops, and this weed-pathogene relationship suggests a factor in this situation. The deleterious effect on stand where beets immediately follow a legume crop, such as alfalfa, sweetclover, or red clover, has been repeatedly confirmed by controlled greenhouse tests and by field observations.

SUGAR-BEET VARIETY, U. S. 217, RESISTS LEAF SPOT

The excellent performance of the first leaf spot resistant variety of sugar beet released, U. S. 217, gives promise that losses from leaf spot may be greatly alleviated as the use of resistant varieties becomes general. This variety, released by the Bureau in 1937, was used on approximately 4,000 acres, with results as a whole equal to those from European brands in common use and greatly superior where leaf spot was a factor. In these intensive evalution tests, conducted at 11 locations, the variety produced 242 pounds more sugar per acre than the check, confirming the 1936 experience. Where leaf spot was a serious factor it far outdistanced the check. Approximately 1,000,000 pounds of seed of U. S. 217 is being used in affected areas in 1938.

DOMESTIC SUGAR-BEET SEED PRODUCTION INCREASING

The striking progress of the sugar-beet seed enterprise, which seeks to produce in the United States adequate supplies of improved sugar-beet varieties for grower use, is shown by the 1937 figures for seed production. More than 12,000,000 pounds of seed were produced on 7,000 acres, located chiefly in the Southwestern States. This production was mostly from plants overwintered in the field, a method of seed production developed by earlier research of the Division (cooperative with the New Mexico Agricultural Experiment Station). In all phases of seed development from choice of variety for a given district, favorable date for planting, method of crop handling, and time to harvest, the research of the Division has preceded the commercial practices, outlining most effective methods.

TOBACCO AND PLANT NUTRITION

W. W. Garner, *in charge*

FERTILIZING ONE SIDE OF TOBACCO PLANT PRODUCES ABNORMAL LEAVES

When any one of the elements nitrogen, phosphorus, potassium, magnesium, sulphur, and iron was withheld from only a portion of the root system of tobacco plants grown in solution cultures, failure of cross transfer has been indicated by development of characteristic deficiency symptoms in the leaves. The cross transfer in some cases failed to take place from one half of the individual leaf to the other. A twisted or one-sided growth due to failure of complete cross transfer was evident with each of the above-mentioned elements and with calcium and boron. These phenomena also have been demonstrated under field conditions in cooperative experiments at the Georgia Coastal Plain Experiment Station, in which the fertilizer was placed only at one side of the plant. In some instances affected leaves developed a larger area on one side of the midrib than on the other, and some plants produced smaller leaves between two larger ones. These malformations did not occur where the fertilizer was applied so as to obtain a uniform distribution in relation to the root system of the plant.

PERMANENT TOBACCO BEDS SATISFACTORY IF STEAM STERILIZED

In all but a few small areas, tobacco growers now depend largely on moving their beds to a new virgin-land location each year in order to avoid weeds and diseases. Shortage of suitable land and new problems such as blue mold point to the advantages of a permanent, easily accessible location where conditions can be better controlled. At present, growers sow excessively large areas and yet are never certain of an adequate plant supply at the proper time. At the Georgia Coastal Plain Experiment Station a stationary steam boiler with a permanent buried-tile system of sterilization has been installed. Tests during the past year show that with this method the time required to sterilize soil is not increased over that of the old pan method, but the depth to which soil was effectively heated is more than doubled. This is an important gain for the large area where the root knot nematode is a problem, as these organisms may be present in large numbers to a depth of as much as 3 feet. The buried-tile installation can be effectively used either for protection against frost or to hasten the growth of the plants. Also in such beds either heat or gas treatment can be employed for the control of blue mold. While the cost of plant production is increased, the advantages seem to justify the extra expense.

TOBACCO VARIETIES RESISTANT TO BLACK ROOT ROT DISCOVERED

Tobacco varieties often have been reported as resistant to black root rot in one area and susceptible in another, and workers have doubted whether the varieties in question actually possessed resistance. It has now been found that there are different races of the causal organism and that a variety may be resistant to a race occurring in Tennessee and susceptible to one occurring in Wisconsin. On the other hand, certain resistant varieties appear to be highly resistant to all races so far found. This knowledge points the way to using only these more widely resistant varieties in breeding work and also indicates that there is little point to studying the inheritance of the resistance characters unless both host plant and parasitic fungus are considered.

TOBACCOS FROM CENTRAL AMERICA RESISTANT TO ROOT KNOT

During the last 3 years hundreds of new collections of tobacco seed have been tested for resistance to the root knot disease. Marked resistance has been found in many of the collections from Central America. In field tests in Georgia, South Carolina, and North Carolina in 1937, the better resistant strains planted on heavily infested soil suffered no damage, while check plantings of ordinary varieties were practically destroyed. By selfing and selection susceptible plant mixtures that were originally present in all collections have been eliminated and lines apparently homozygous for resistance crossed with Orinoco varieties. Preliminary tests of F_2 progenies indicate a sharp segregation for resistance and susceptibility.

BLUE MOLD IN TOBACCO BEDS CONTROLLED BY GAS TREATMENTS

Determinations of benzol-air concentrations have shown that with the standard 16-hour (overnight) treatment, effective control of blue mold of tobacco was obtained with a concentration that rose to a maximum of 0.1 percent. Since concentrations as high as 0.45 percent were used without injury to the plants, the margin of safety is very wide. However, at two locations where gas treatments have been in use for 2 years, serious root injury developed in fall-sown beds (1937). Tests with different grades of cotton covers, used to hold in the benzol vapors, show that with each decrease in tightness, from a cloth that was practically gas-proof, the efficiency of the treatment was reduced. At present it appears that cloth with thread counts less than 40 per square inch cannot be used and that counts between 55 and 65 are desirable. Several new materials have been found that control blue mold effectively when used as gas. The most promising is paradichlorbenzene. This material, pulverized and scattered on "evaporating boards," is simpler to handle than benzol. One ounce of it was equal to about 5 fluid ounces of benzol.

IMPROVED STRAIN OF CONNECTICUT HAVANA TOBACCO DEVELOPED

A good quality strain of Havana Seed tobacco resistant to black root rot disease has long been needed in the Connecticut Valley. To meet this need, Havana Seed 211 has been produced. It is not only highly resistant to black root rot but is also much more resistant than common Havana Seed to flea beetles and thrips. In appearance it resembles very closely common Havana Seed. In a 6-year test, considering both yield and quality, Havana Seed 211 surpassed common Havana Seed on disease-free soil by 21 and on infested soil by 88 percent.

GALLIUM A NEW ESSENTIAL ELEMENT FOR PLANT GROWTH

The chemical element gallium has been found essential for the growth and reproduction of *Aspergillus niger* in nutrient solution culture. Though only 10 to 20 parts of the element per billion of nutrient solution are required for maximum growth, its omission resulted in a 60-percent loss in yield. Gallium is required in addition to iron, zinc, copper, manganese, and molybdenum. A total of 77 elements were substituted for gallium in the nutrient solution, but all were found ineffective.

WESTERN IRRIGATION AGRICULTURE

C. S. Scofield, *in charge*

BORON INJURY CONTROLLED BY ELIMINATING OR BLENDING CONTAMINATED WATER

In addition to routine investigations of the quality of irrigation and drainage waters, definite progress has been made in the elimination of boron-contaminated water and in blending such supplies with good water to dilute the contamination to subtoxic concentrations. As a result, within the last few years irrigation districts in California have taken active measures to improve the quality of their irrigation waters.

There is a great diversity among soils in relation to boron fixation. Some soils appear to fix relatively large quantities of boron while others fix much less. This factor appears to be closely correlated with the texture of the soil, light soils fixing less than the heavier types.

GRASS SEED PRODUCTION A PROMISING ENTERPRISE ON IRRIGATED LAND

Extensive acreages of both Dallis and Bahia grasses are being planted throughout the southeastern part of the United States. However, under humid conditions seed from these two grass varieties cannot be produced, consequently this country is dependent on foreign importations. Tests made in 1937 at the United States Yuma Field Station, Bard, Calif., indicate very promising prospects for the production of seed from these grasses under the climatic conditions existing in southern California and Arizona.

Another important feature of the work carried on at this station is the alfalfa wilt-resistant nursery studies in cooperation with the Division of Forage Crops and Diseases. Fall plantings of the desired strains are made at the Yuma station, and the resulting plants are shipped to northern points, including Nebraska, Kansas, Utah, and Wisconsin, in the early spring for testing and further breeding. It has been found that this procedure has shortened by a full year the time formerly required to bring the plant to fruiting age.

ARLINGTON EXPERIMENT FARM

E. C. Butterfield, *in charge*

ARLINGTON FARM A FIELD LABORATORY FOR THE DEPARTMENT

The appropriation under which the Arlington Experiment Farm is conducted provides for the operation and maintenance of the station to furnish facilities and service to the large number of research activities of the Department located thereon. Improvements on the farm during the year consisted largely of additional heating plant equipment, shop equipment, agricultural implements, and extensions to the electric, tile-drainage, and irrigation systems.

EXPERIMENTAL GREENHOUSES

J. W. Byrnes, *in charge*

NEW VARIETIES OF FLOWERS RELEASED

This year three carnation seedlings, developed in the Bureau breeding program, were named: Blaze, Burgundy, and Glory. Rooted cuttings of these varieties were distributed to 24 growers for trial. There is still a heavy demand for the new carnation varieties Carlotta, Rigoletto, and Mavourneen, and a great number of rooted cuttings of these varieties were distributed. These three varieties are displacing older varieties in the trade. The chrysanthemums recently named Japanese, Gay Nineties, Pompons, Pippin, Break o' Day, Tint o' Tan, and Ballerina were distributed to growers. Newer varieties of croton (*Codiaeum*) also were released.

PUBLICATIONS, INFORMATION, EXTENSION

During the year 153 publications (139 new and 14 revised) contributed by the Bureau were issued in the Department series. These comprised 45 papers in the Journal of Agricultural Research, 16 technical bulletins, and 92 other items, semitechnical or popular. In addition, there appeared in outside scientific, agricultural, and commercial publications 456 articles written by members of the Bureau's staff on various subjects related to its field of activity. A list showing the new official publications and most of the outside contributions is appended.

The Bureau continued to cooperate with the Press Service and the Radio Service of the Office of Information in preparing and furnishing informational material.

Through three extension specialists, cooperatively maintained, dealing respectively with plant-disease control, horticulture, and agronomy, cooperation was continued with the Department's Extension Service and the State agricultural extension services in making available to farmers the practical benefits of research.

LIST OF PUBLICATIONS

CEREALS

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REPORT OF THE CHIEF OF THE BUREAU OF PUBLIC ROADS, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF PUBLIC ROADS,
Washington, D. C., September 15, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith the report of the Bureau of Public Roads for the fiscal year ended June 30, 1938.

Sincerely yours,

THOMAS H. MACDONALD, *Chief.*

CONTENTS

	Page
Introduction	1
Modernization of Federal-aid system now most important feature of Federal-aid program	2
Greatest needs on main roads are widening, longer sight distances, and reduction of curvature	2
Construction of secondary or farm-to-market roads	3
Highway safety	4
Feasibility of superhighways to be studied and reported	5
Sources of funds used during the fiscal year	5
Employment on road work	6
Administration of Hayden-Cartwright Act penalizing diversion of motor-user revenues from highway purposes	9
Federal-aid legislation amended and funds authorized for 1940 and 1941	9
Mileage of Federal-aid system	10
Status of major funds and progress in construction	11
Progress in Public Works highway construction	12
Works Program highway construction	12
Progress in Federal-aid road construction on Federal-aid system	12
Progress in construction of secondary roads with Federal aid	13
Grade-crossing elimination and protection program	13
Summary	14
Construction of roads through public lands and Federal reservations	48
Restoration of flood-damaged roads	50
Work relief highway projects	51
Loan-and-grant highway projects	52
National-forest road construction	55
Road construction in national parks and monuments	59
Inter-American highway	62
Transportation, economic, and statistical investigations	64
Highway-planning surveys	64
Safety research	66
Maintenance-cost studies	66
Highway-capacity and vehicle-performance studies	66
National Conference on Street and Highway Safety	67
American Association of Motor Vehicle Administrators	67
Estimating highway-traffic volume	67
Railroad-abandonment studies	67
Physical research	67
Subsurface exploration	68
Motor-vehicle impact investigations	68
Measurement of road-surface roughness	68
The structural design of concrete pavements	68
Erosion test for culvert pipe	69
The structural design of nonrigid pavements	69
Investigation of supporting strength of flexible culvert pipe in earth embankments	69
Investigation of bridge floors	69
Fatigue strength of welded joints	69
Cements, aggregates, and concrete	70
Bituminous road materials	70
Subgrade investigations	71

INTRODUCTION

Highway construction of all types administered by the Bureau during the year resulted in the improvement of 15,345 miles, the elimination of 711 grade crossings, reconstruction of 144 obsolete grade-crossing structures, and protection of 744 highway-railroad crossings by signs and signals. Both the amount of work done per mile of improvement, and the total mileage improved, have considerably exceeded the average rates over the past 10 years.

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This year marks the initiation of Federal aid for secondary or farm-to-market roads and grants of funds for highway-railroad grade-crossing elimination as parts of the regular Federal highway program. These classes of work were begun in the emergency program to relieve unemployment and were included in the regular program by the act of June 16, 1936, which authorized $25,000,000 for secondary roads, to be matched by the States, and a grant of $50,000,000 to pay the full cost of constructing grade-crossing eliminations.

The greater part of the work administered by the Bureau was carried on in cooperation with and under the immediate supervision of the State highway departments. In this way, improvements were completed on 9,333 miles of the rural portion of the Federal-aid highway system, 2,037 miles of secondary or feeder roads, and 760 miles of roads and streets in municipalities. Improvements in Federally controlled areas, reconstruction of flooded-damaged roads, and construction of roads with funds allotted by other Federal agencies aggregated 3,215 miles.

MODERNIZATION OF FEDERAL-AID SYSTEM NOW MOST IMPORTANT FEATURE OF FEDERAL-AID PROGRAM

The system of main highways in the United States is by far the most extensive of any in the world. Only the most out-of-the-way places cannot now be reached over a surfaced road. Many miles of main highways are broad, direct routes over which vehicles can travel continuously at the touring speed selected by the driver without the need for slowing down because of sharp curves, steep grades, or other obstacles and there is frequent opportunity to pass overtaken vehicles. However, there is a large mileage of roads that cannot be traveled with such facility and ease; roads on which the driver must accommodate himself to conditions that are definitely inferior to present-day standards.

This is a condition that has been unavoidable and that is being corrected as rapidly as the necessary funds can be obtained. When the States and the Federal Government began the improvement of highways the network connecting our cities was largely unimproved. These roads had been planned for horse-drawn vehicles and the pioneer automobilists made few long trips over them. That such a large part of the network of main highways can now be traveled with ease and comfort is due to the intelligent, long-time distribution of annually limited funds over a selected system. A degree of improvement was effected, which, though generally recognized as less than that which would ultimately be necessary, was still sufficient to serve the immediate need. As the need for further improvement of various sections has become evident it has been met as promptly and as fully as was consistent with the early completion of a desirable minimum improvement of the system as a whole. This policy, sometimes called stage construction, is the only one under which the Federal-aid system and the more extensive State systems could have been improved in a short space of time to a general condition which permits their present use by a traffic of 150 billion vehicle-miles annually.

There are few sections of the Nation's network of main highways that have not been initially, if inadequately, improved. State and Federal appropriations, in large part, are now being devoted to supplementary improvements on the less adequate sections.

Many of our most used and important roads are among those that must now be classed as very inadequately improved. These are the roads that were first recognized as of outstanding importance and as such were first improved with surfaces of the highest type designed according to the standards of early road builders. There was general acceptance of these standards as sufficiently advanced—in fact, there was much opposition on the grounds that they were too advanced. The great increase in highway use and the recent marked increase in vehicle speed have forced the adoption of much higher standards.

GREATEST NEEDS ON MAIN ROADS ARE WIDENING, LONGER SIGHT DISTANCES, AND REDUCTION OF CURVATURE

Eliminating those curves that have become traffic hazards at the now normal driving speed and increasing sight distances by road straightening and by grading at the tops of hills are widespread needs on the existing main highways. These defects are found generally on roads in every part of the country and their danger to traffic is the consequence of an increase in vehicle speed far beyond what was visioned 15 or 20 years ago and far in excess of the legal limitations that existed in most States.

Greater surfaced width of road is of equal importance. There has always been the pressure to stretch highway funds beyond their limit to improve as many miles as possible. Surfaced width has been sacrificed for surfaced length. First 12- and 14-foot road surfaces were built, then widths were increased to 16 feet, and later to 18 feet, and for some years 20 feet has been the standard width for two-lane roads. The Federal Highway Act of 1921 demanded no greater width than 18 feet. Many of the older roads have been widened to this standard, generally as a part of a resurfacing operation. Here the wisdom of the stage-construction policy has been conspicuously demonstrated. The initial surfacing has caused a flow of traffic on the road with a corresponding flow of motor revenues for highways that is being used, in considerable part to remedy inadequate conditions. While many roads have been widened there is still much of this work to be done. The cost per mile of such work is not great unless it is accompanied by other improvements.

Within the last few years there has been a pronounced and desirable trend toward surfacing two-lane highways to widths greater than 20 feet to accommodate the greater volume of traffic moving at higher speeds. While many new surfaces are now being constructed 22 feet wide, a surfaced width of 24 feet will soon come to be generally recognized as a desirable standard for important two-lane highways.

Heavy expense for road widening only is not incurred until the traffic volume is so great that it cannot be accommodated safely by two traffic lanes. Provision of a third lane is sometimes resorted to and while this expedient involves only a moderate expense, it is not a satisfactory solution of traffic-congestion problems.

For great volumes of traffic, such as flow on the main highways adjacent to large cities and between some of the larger cities that are close together, the multiple-lane highway is the only satisfactory solution. Experience with the first four-lane roads quickly resulted in the almost unanimous conclusion that traffic flowing in opposite directions must be separated by a dividing strip of some sort if a heavy accident toll is to be avoided.

Divided four-lane roads are relatively expensive. They are necessary where population is dense and right-of-way costs are therefore high. The central strip or grass plot dividing the highway adds further to the cost. In the future, provision for pedestrians and other services must be made along these highways and will add still further to the cost.

While the cost of properly designed four-lane roads is high, the needed expenditures in this direction do not overshadow those needed for the other purposes that have been described. Highway-planning surveys being conducted in cooperation with 46 States are resulting in an accurate picture of the flow of traffic on the main highways. These data indicate that there is not a very large mileage of highways on which four or more traffic lanes are required for the reasonable accommodation of present traffic from the standpoint of total vehicles moving. There now exists more than 3,400 miles of such width, but on the greater portion of this mileage there is no provision for the physical separation of traffic moving in opposite directions. The normal increase of traffic will add to the need for four-lane highways and a considerable portion of the existing undivided four-lane highways must be further improved so as to accomplish a separation of opposing traffic lanes. It is evident, therefore, that the provision of facilities of this general class is lagging very far behind actual needs.

CONSTRUCTION OF SECONDARY OR FARM-TO-MARKET ROADS

Since the Federal Government first undertook the construction of secondary or farm-to-market roads in the emergency program initiated in 1933, there has been completed under Bureau supervision more than 31,000 miles of such road. This is considerably in excess of the Federal-aid roads constructed in the first 7 years of operation of the Federal-aid plan.

Employment of labor was the immediate objective of the emergency program and to this end projects for improvement were selected without delay. The selection was not a particularly difficult problem with so many much-used secondary roads demanding improvement but more careful selection of these highways is necessary if they are to give the greatest service. Improvement of secondary roads as part of the regular Federal-aid program, begun in the past year, has supplied the opportunity to undertake the planning of a connected system and methods of financing a continuing program.

The highway-planning surveys, described on page 64, have as one of their most important objectives the supplying of all data needed in designating those secondary roads to be improved immediately and in annual programs to follow with definite provision for meeting all necessary costs.

The rural highway program of the future should be directed along two principal lines: (1) The maintenance and needed enlargement of the serviceability of the main highways, and (2) the extension of reasonable improvement to those secondary and feeder roads that directly contribute to the permanent use of rural lands. There is a close relation between these classes of roads both in usage and in the sources from which funds are drawn for their support. Expenditures made for one class will necessarily affect the amounts that can be made available for the other class. It is therefore of the greatest importance that the relative needs of each class be determined with all possible accuracy and that improvement of each class be planned with full consideration of these facts. Any other course must inevitably lead to unbalanced programs and economic loss resulting from inadequate highway service. The highway-planning surveys are producing the needed facts and the Bureau is cooperating with the States in developing highway programs, giving full attention to the designation of secondary road systems.

HIGHWAY SAFETY

The safety of highway users is a first responsibility with all who plan and build the highways. Defects in the existing system are fully recognized and the speed with which they will be corrected depends primarily on the rate at which funds can be made available for the purpose. The program of highway modernization, including road straightening and widening, increasing sight distances, grade-crossing elimination, and construction of service roads and sidewalks should go forward with all possible speed. At the same time it must be realized that accomplishment of all these things will not constitute a solution of the accident problem. The present condition of the main highways is not conducive to accidents except when rendered so by risk-taking drivers. The data available on the causes of accidents indicate that improper acts by vehicle drivers are the element common to most accidents. The number of accidents and deaths can be materially lessened only by centering the attack on driving habits and a proper selection of drivers. Education and persuasion are being widely used and are well worth while but many of the most dangerous drivers will respond only to more positive measures.

A careful and detailed study of all available data on highway accidents has been made by the Bureau with the aid of experts in traffic control and law enforcement. There resulted a number of findings some of which are immediately useful in accident prevention and others point the way in further studies. Despite the availability of the vehicle code recommended by the National Conference on Street and Highway Safety there is still great lack of uniformity in essential features of State motor-vehicle and highway laws. There is undesirable variation in methods of recording and analyzing accident data. Accidents do not ordinarily result from single causes but from combinations of contributing causes. There is a relatively small group of definitely accident-prone drivers who experience a relatively large number of accidents. Drivers of 16 to 25 years in age have more than their share of accidents. Disciplining and control of delinquent drivers are in many instances, strikingly deficient. Highway police organizations are usually so small and so occupied with other duties as to be unable to operate effectively in motor-vehicle law enforcement and accident prevention. There are many improperly adjusted or inadequately maintained motor vehicles.

Improvement of the present situation will require concerted action by the numerous agencies concerned with traffic control and law enforcement. Immediate action should be taken toward the adoption by the States of the uniform motor-vehicle code recommended by the National Conference on Street and Highway Safety. There is urgent need for uniformity in speed laws, stopping and turning regulations, and other phases of traffic control. All States should provide for rigid examination of applicants for drivers' licenses. Motor vehicles should be inspected at regular intervals to insure that those poorly equipped and defective are kept off the road.

Expanded patrol forces are required for the enforcement of traffic laws; and violators, when arrested and convicted, must be punished without fear or favor. Mandatory revocation of the driving license should follow the more serious violations and the repetition of violation. Other steps to be taken include the skilled investigation of traffic accidents, the establishment of a uniform system of compulsory accident reporting, a national program of safety education, and a

highway-improvement program designed to eliminate as rapidly as possible all recognized dangerous conditions.

FEASIBILITY OF SUPERHIGHWAYS TO BE STUDIED AND REPORTED

There has been wide public interest in the creation of a system of multiple-lane highways, built according to the highest standards of grade and alinement, with opposing traffic separated by a center parkway, bypassing all cities, with structures separating streams of traffic at all highway and rail crossings, and with access from side roads permitted only at carefully selected points. The large volumes of traffic that flow between densely populated areas, when not too widely separated, in many instances appear to justify the high cost of such improvement.

The Bureau is now making studies that should indicate rather definitely the need for such highways and the extent to which they may be expected to be self-supporting. The Federal-aid Highway Act of 1938 directs the Bureau to investigate the feasibility of building and the cost of superhighways, not exceeding three in number, running in a general direction from the eastern to the western portion of the United States, and not exceeding three in number, running in a general direction from the northern to the southern portion of the United States, including the feasibility of a toll system on such roads. A report is to be made to Congress not later than February 1, 1939.

The highway-planning surveys conducted by the Bureau in cooperation with 46 States are yielding data on the flow of traffic on the main highways of the Nation and the extent to which this traffic is a through movement and might be concentrated on special-service highways. The problem is one of determining the number of highway users that might be expected where tolls are charged and whether the expected revenue would support the cost of the highways.

SOURCES OF FUNDS USED DURING THE FISCAL YEAR

In contrast with the preceding year when emergency highway and grade-crossing appropriations supplied the larger part of the funds available, the fiscal year 1938 marked an almost complete return to work supported by annual Federal-aid authorizations. The apportionment for the fiscal year was $125,000,000 for improvement of the Federal-aid system, $25,000,000 for secondary or farm-to-market roads, and $50,000,000 for elimination of hazards at highway-railroad grade crossings. The States were required to match the first two of these funds but the grade-crossing funds were available to pay the full construction cost. The apportionment by States was shown in the last annual report.

The year began with $293,739,309 available for programmed projects that had not been advanced to the contract stage. Of this amount $33,189,957 was the remainder of the emergency funds provided to furnish employment through highway improvement.

On December 31, 1937, the $200,000,000 authorized for the fiscal year 1939 was apportioned to the States after first deducting $5,000,000 for administrative expenses of the Bureau as authorized by law. The apportionment is shown in able 1.

TABLE 1.—*Apportionments of Federal aid for the fiscal year 1939 for roads on the Federal-aid highway system, for secondary or feeder roads, and for grade-crossing eliminations*

State	Federal-aid system	Secondary or feeder	Grade crossings	Total
Alabama	$2,600,165	$520,033	$986,449	$4,106,647
Arizona	1,785,984	357,197	315,619	2,458,800
Arkansas	2,132,790	426,558	865,366	3,424,714
California	4,735,268	947,054	1,825,553	7,507,875
Colorado	2,271,785	454,357	632,565	3,358,707
Connecticut	785,963	157,193	417,706	1,360,862
Delaware	609,375	121,875	243,750	975,000
Florida	1,669,497	333,899	692,981	2,696,377
Georgia	3,154,850	630,970	1,194,288	4,980,108
Idaho	1,538,178	307,636	404,755	2,250,569
Illinois	5,095,276	1,019,055	2,579,163	8,693,494
Indiana	3,063,178	612,636	1,270,383	4,946,197
Iowa	3,200,927	640,185	1,362,859	5,203,971
Kansas	3,283,179	656,636	1,271,424	5,211,239
Kentucky	2,299,072	459,814	894,871	3,653,757

TABLE 1.—*Apportionments of Federal aid for the fiscal year 1939 for roads on the Federal-aid highway system, for secondary or feeder roads, and for grade-crossing eliminations*—Continued

State	Federal-aid system	Secondary or feeder	Grade crossings	Total
Louisiana	$1,791,188	$358,238	$777,845	$2,927,271
Maine	1,089,359	217,872	338,735	1,645,966
Maryland	1,018,447	203,689	506,840	1,728,976
Massachusetts	1,725,964	345,193	1,021,971	3,093,128
Michigan	3,784,165	756,833	1,620,378	6,161,376
Minnesota	3,402,720	680,544	1,313,891	5,397,155
Mississippi	2,196,926	439,385	777,444	3,413,755
Missouri	3,774,930	754,986	1,496,333	6,026,249
Montana	2,553,444	510,689	653,267	3,717,400
Nebraska	2,579,115	515,823	871,434	3,966,372
Nevada	1,590,172	318,034	243,750	2,151,956
New Hampshire	609,375	121,875	243,750	975,000
New Jersey	1,662,041	332,408	972,568	2,967,017
New Mexico	1,993,177	398,635	419,200	2,811,012
New York	6,105,009	1,221,002	3,345,530	10,671,541
North Carolina	2,919,413	583,883	1,242,912	4,746,208
North Dakota	1,939,847	387,969	776,153	3,103,969
Ohio	4,517,858	903,572	2,087,464	7,508,894
Oklahoma	2,928,955	585,791	1,125,334	4,640,080
Oregon	2,048,413	409,683	565,844	3,023,940
Pennsylvania	5,291,737	1,058,347	2,826,864	9,176,948
Rhode Island	609,375	121,875	243,750	975,000
South Carolina	1,671,209	334,242	736,174	2,741,625
South Dakota	2,029,328	405,866	674,361	3,109,555
Tennessee	2,616,339	523,268	933,280	4,072,887
Texas	7,787,739	1,557,548	2,674,043	12,019,330
Utah	1,410,802	282,160	321,103	2,014,065
Vermont	609,375	121,875	243,750	975,000
Virginia	2,269,875	453,975	935,084	3,658,934
Washington	1,956,342	391,268	750,582	3,098,192
West Virginia	1,357,927	271,585	652,386	2,281,898
Wisconsin	3,030,337	606,067	1,220,638	4,857,042
Wyoming	1,559,860	311,972	331,769	2,203,601
District of Columbia			243,750	243,750
Hawaii	609,375	121,875	243,750	975,000
Puerto Rico	609,375	121,875	360,341	1,091,591
Total	121,875,000	24,375,000	48,750,000	195,000,000

EMPLOYMENT ON ROAD WORK

Employment on highway work with Federal funds administered by the Bureau declined from 1,792,760 man-months in the fiscal year 1937 to 1,262,202 man-months in the past year. This was a direct result of the near exhaustion of the various special funds appropriated in previous years to provide employment. Employment provided by the emergency funds apportioned to all States dropped from 1,009,323 man-months in 1937 to 273,696 man-months in 1938. This was partly offset by an increase in the employment on regular Federal-aid highway and grade-crossing work which amounted to 538,579 man-months in 1937 and 778,488 man-months in 1938. Table 2 shows the employment in each of the fiscal years 1932 through 1938 by months. Table 3 shows the employment furnished in 1938 on each class of work administered by the Bureau and on State work done without Federal assistance.

TABLE 2.—*Comparison of employment during the fiscal years 1932–38 on all Federal and Federal-aid highway construction and on all Federal and State road work, including State maintenance, by months*

Month	Men employed on all Federal and Federal-aid highway construction							Total men employed on all Federal and State highway construction and maintenance						
	1932	1933	1934	1935	1936	1937	1938	1932	1933	1934	1935	1936	1937	1938
July	164,708	81,042	129,205	335,223	191,041	249,271	159,489	385,349	305,372	332,277	549,203	375,442	435,971	334,536
August	151,418	89,346	111,211	297,224	178,756	247,841	163,331	389,949	333,403	329,813	531,034	382,846	433,533	351,853
September	116,100	122,193	115,047	247,880	143,455	227,916	152,784	356,617	374,405	337,973	498,151	340,073	414,147	346,444
October	88,869	124,106	154,016	210,079	135,660	206,113	143,617	330,104	373,246	384,029	450,322	323,374	389,966	330,942
November	62,466	129,933	185,860	201,046	118,898	172,295	121,394	289,316	371,667	420,069	426,603	290,523	353,971	314,067
December	35,991	98,271	174,358	147,101	103,493	128,314	85,365	244,971	290,465	362,031	323,700	252,229	288,248	255,530
January	29,518	75,498	154,154	96,594	82,731	76,829	54,899	229,189	266,443	315,989	240,414	202,884	210,027	196,858
February	26,673	78,215	156,814	81,257	70,418	57,844	49,713	218,218	255,256	306,090	221,406	200,451	190,336	177,675
March	28,008	95,704	144,053	90,999	86,050	69,946	51,229	211,549	279,213	296,265	217,539	227,586	200,794	179,420
April	42,205	122,256	187,657	123,063	132,834	88,361	67,829	245,843	299,882	345,278	282,740	287,478	226,286	213,802
May	59,008	139,831	271,972	167,535	193,269	122,655	98,179	259,615	330,138	466,504	331,000	374,191	299,063	272,316
June	71,772	152,276	336,414	193,263	237,330	145,375	114,373	280,636	359,605	545,013	362,339	423,466	313,149	294,240
Total (man-months)	876,736	1,308,671	2,120,761	2,191,264	1,673,935	1,792,760	1,262,202	3,441,356	3,839,095	4,441,331	4,434,451	3,680,543	3,755,491	3,267,683

TABLE 3.—*Direct job employment during the fiscal year 1938 on the several classes of Federal and Federal-aid road construction administered by the Bureau of Public Roads and State road construction and maintenance*

Month	Men employed on road construction										Men employed on road maintenance by State highway departments	Total men employed
	In whole or in part with Federal funds									With State funds only, on State highways		
	National-forest highways	National-park highways	Public-lands highways	Federal-aid highways and grade-crossing eliminations	Public Works highways	Works Program highways	Works Program grade-crossing eliminations	Loan-and-grant highways [1]	National work-relief highways			
July	2,055	4,674	180	84,604	3,761	23,215	21,456	14,861	4,683	25,140	149,907	334,536
August	2,949	4,987	299	90,905	3,974	20,222	19,268	16,612	4,115	28,379	160,143	351,853
September	3,574	4,403	348	88,792	3,068	17,712	17,112	14,058	3,717	26,632	167,028	346,444
October	3,715	3,680	354	86,058	2,466	15,623	15,491	13,032	3,198	27,280	160,045	330,942
November	3,161	2,344	310	74,522	2,019	12,333	12,810	10,761	3,134	29,491	163,182	314,067
December	1,477	1,552	334	50,622	1,489	8,112	9,512	9,034	3,233	23,825	146,340	255,530
January	695	824	251	32,074	1,141	4,427	6,175	6,314	2,998	15,394	126,565	196,858
February	340	826	225	30,806	1,083	3,265	4,812	5,117	3,239	12,252	115,710	177,675
March	258	983	206	33,295	1,053	3,048	4,164	4,673	3,549	11,379	116,812	179,420
April	516	1,351	237	47,225	1,242	3,917	4,628	5,308	3,405	14,073	131,900	213,802
May	937	2,315	390	72,378	2,351	4,793	5,353	6,433	3,229	17,674	156,463	272,316
June	1,598	2,782	280	87,207	2,105	4,635	5,861	6,769	3,136	19,875	159,992	294,240
Total (man-months)	21,275	30,721	3,414	778,488	25,752	121,302	126,642	112,972	41,636	251,394	1,754,087	3,267,683

[1] Projects transferred by the Public Works Administration for engineering supervision.

As the Federal highway program passed out of the emergency employment stage and restrictions on contractors regarding employment of labor were no longer applied the employment of individual workers became more continuous and the weekly wage increased.

The total employment for the year on work supervised by the Bureau—1,262,202 man-months—is the equivalent of an average full-time employment each month of 105,180 men. The number of individuals actually employed, some of them on a part-time basis, averaged approximately 145,000 persons per month. Indirect employment in the production and transportation of equipment and materials is estimated at 1.7 times the direct employment for work of the character done during the year, indicating an indirect employment of 2,146,000 man-months, and this, added to the direct employment, gives a full-time employment of 3,408,000 man-months, the equivalent of the full-time continuous employment of 284,000 men.

Employment on State construction financed entirely with State funds and on State maintenance work increased slightly over the employment in the preceding year. Such work is financed almost entirely with State motor-vehicle revenues which furnish an income not subject to marked fluctuations from year to year and the resulting employment is correspondingly uniform.

ADMINISTRATION OF HAYDEN-CARTWRIGHT ACT PENALIZING DIVERSION OF MOTOR-USER REVENUES FROM HIGHWAY PURPOSES

The Hayden-Cartwright Act of 1934 requires that any State that applies to highway purposes a lesser amount of motor-vehicle fees and gasoline taxes than was provided by law on June 18, 1934, shall be penalized not more than one-third of the Federal-aid apportionments to which it would otherwise be entitled.

Administration of this requirement is placed under the Secretary of Agriculture and has necessitated a continuous study of State laws pertaining to disposition of motor-user revenue.

During the past year a careful review of official reports showed that motor-vehicle revenues had been diverted from highway purposes by legislative acts in New Jersey and Massachusetts. A reduction of $250,000 in the Federal-aid funds apportioned to New Jersey for the fiscal year 1937 was made on August 7, 1937. On June 2, 1938, there was withheld from Massachusetts $472,862 of the apportionment to that State for the fiscal year 1938.

In the preceding fiscal year State officials of Georgia were notified that the State had used motor-vehicle revenues for nonhighway purposes to such an extent as to require Federal action. Georgia officials gave assurance that required amounts would be restored to highway funds but satisfactory action has not yet been taken by the State.

FEDERAL-AID LEGISLATION AMENDED AND FUNDS AUTHORIZED FOR 1940 AND 1941

Authorization of Federal-aid funds for the fiscal years 1940 and 1941 and for other road building administered by the Bureau was made by the act of June 8, 1938. The authorizations are as follows:

Item	1940	1941
Federal-aid system	$100,000,000	$115,000,000
Secondary or farm-to-market roads	15,000,000	15,000,000
Elimination of hazards at grade crossings	20,000,000	30,000,000
National-forest roads	10,000,000	13,000,000
National-park roads	4,000,000	5,000,000
Parkways	6,000,000	8,000,000
Public-land roads	1,000,000	2,000,000
Indian roads	2,500,000	3,000,000

The new legislation made the District of Columbia eligible for participation in all regular Federal-aid funds beginning with the fiscal year 1940. Heretofore the District has participated in emergency highway funds and in grade-crossing funds for 1938 and 1939 but not in regular Federal-aid for highways.

Roadside and landscape development, including such sanitary and other facilities as may be deemed reasonably necessary to provide for the suitable accommodation of the public, are now specifically authorized as a part of Federal-

aid work. The purpose of this legislation is to remove any doubt as to the authority for these classes of improvements.

States devoting all motor-vehicle revenues to certain highway purposes and still unable to match Federal-aid funds for 1938 and 1939 may be relieved of matching under a provision of the new act. A State that applies all proceeds of special taxes on motor-vehicle transportation to highway purposes and expends 90 percent of them for administrative and operating expenses of the State highway department, maintenance of Federal-aid and State highways, and payment of interest and principal on highway debts for which such revenues have been pledged, may be relieved of matching Federal-aid funds to the extent that it lacks funds for this purpose.

Near the close of the fiscal year a study was made of the use of motor-vehicle revenue in Arkansas which showed that they were being used in accordance with the above provisions. Shortly after the close of the year the Secretary of Agriculture announced that the State would be relieved of the necessity of matching 1938 and 1939 funds to the extent that State funds were lacking.

MILEAGE OF FEDERAL-AID SYSTEM

The Federal-aid system was designated as a result of the Federal Highway Act of 1921 and in accordance with the intention of the act there has been close adherence to the original system. Only minor revisions have been made to meet unforeseen conditions. The mileages have been changed slightly from year to year as estimated mileages or mileages along old roads have been replaced by the measured mileage on new construction.

The original system was limited to 7 percent of the rural road mileage within each State. When provision has been made for improvement of 90 percent of the designated system an additional 1 percent is permitted and further additions are permitted on the same basis. This provision is becoming of increasing importance and has been taken advantage of by 24 States. During the past year the mileage of the system outside of Federal reservations increased by 2,165 miles due almost entirely to extensions beyond the original 7 percent.

The system in any State may exceed what would otherwise be the limiting mileage by an amount equal to the mileage of the system within Federal reservations. Additions to the system in reservations amounted to 1,320 miles bringing the total additions for the year to 3,485. System mileages by States are shown in table 4.

TABLE 4.—*Designated Federal-aid highway system mileage as of June 30, 1938*

State	Mileage of approved routes outside Federal reservations	Mileage of approved routes within Federal reservations	Total mileage of system	State	Mileage of approved routes outside Federal reservations	Mileage of approved routes within Federal reservations	Total mileage of system
Alabama	3,933		3,933	New Hampshire	968	33	1,001
Arizona [1]	1,617	597	2,214	New Jersey [1]	1,567		1,567
Arkansas	5,029	175	5,204	New Mexico	3,275	377	3,652
California [1]	5,581	555	6,136	New York [1]	9,078	16	9,094
Colorado	3,211	514	3,725	North Carolina [1]	7,080	507	7,587
Connecticut [1]	1,046		1,046	North Dakota	7,139	85	7,224
Delaware [1]	824		824	Ohio [1]	7,109		7,109
Florida [1]	2,479		2,479	Oklahoma	6,474	48	6,522
Georgia	5,654	73	5,727	Oregon [1]	3,272	482	3,754
Idaho	2,549	772	3,321	Pennsylvania [1]	7,656	108	7,764
Illinois [1]	9,004	8	9,012	Rhode Island [1]	518		518
Indiana [1]	5,340		5,340	South Carolina [1]	4,020	196	4,216
Iowa [1]	7,703	2	7,705	South Dakota	5,803	477	6,280
Kansas	8,670	15	8,685	Tennessee	4,566	66	4,632
Kentucky	3,700	6	3,706	Texas [1]	14,174	127	14,301
Louisiana	2,756		2,756	Utah [1]	2,085	146	2,231
Maine	1,617	4	1,621	Vermont	1,036		1,036
Maryland [1]	2,195		2,195	Virginia [1]	4,568	82	4,650
Massachusetts [1]	1,674		1,674	Washington	2,938	404	3,342
Michigan [1]	5,729	233	5,962	West Virginia	2,214	29	2,243
Minnesota	7,174	291	7,465	Wisconsin	5,508	133	5,641
Mississippi	3,699	10	3,709	Wyoming	3,222	337	3,559
Missouri [1]	7,975		7,975	Hawaii	539		539
Montana	4,390	1,058	5,448	Puerto Rico	858		858
Nebraska	5,598	21	5,619				
Nevada [1]	1,760	54	1,814	Total	216,574	8,041	224,615

[1] Increased beyond 7 percent.

STATUS OF MAJOR FUNDS AND PROGRESS IN CONSTRUCTION

During the year 12,129 miles of highway were brought to completion, exclusive of work done in Federal areas and with special funds. The completed work included 9,333 miles on the Federal-aid system outside of municipalities, 559 miles on extensions of the system into and through municipalities, 201 miles of secondary or feeder roads in municipalities, and 2,036 miles of secondary or feeder roads outside of municipalities. Payments to the States for construction completed amounted to $218,637,062, as shown in table 5.

TABLE 5.—*Funds paid to the States during the fiscal year 1938*

State	Federal aid, 1917–33	Public Works, 1934–35	Works Program		Federal-aid system, 1936–39	Federal aid, secondary or feeder	Federal aid, grade crossings	Total
			Highways	Grade-crossings				
Alabama	$20,545	$132,833	$338,184	$444,580	$2,492,584	$40,365	$108,680	$3,577,771
Arizona		23,427	208,265	201,391	2,045,124	67,854	4,718	2,550,779
Arkansas		120,402	263,840	499,473	2,817,299	2,757	56,681	3,760,452
California		439,792	844,199	1,026,711	4,812,670	78,564	310,743	7,512,679
Colorado		22,933	193,478	761,122	1,943,618	66,404	4,000	2,991,555
Connecticut		265,702	693,773	902,485	234,332			2,096,292
Delaware		4,460	140,439		96,548			241,447
Florida		87,623	296,711	421,548	1,305,059	118		2,111,059
Georgia		910,653	2,493,801	1,485,334	2,711,419	21,832		7,623,039
Idaho		20,737	62,011	452,148	1,647,706	147,486	66,501	2,396,589
Illinois		599,152	891,053	3,360,116	6,057,598	127,280	163,800	11,198,999
Indiana		121,449	564,724	756,083	3,054,514		247,503	4,744,273
Iowa		26,910	749,176	1,449,680	3,940,950		472,245	6,638,961
Kansas		48,641	420,035	613,929	2,415,945	7,735	340,425	3,846,710
Kentucky		60,003	653,145	1,348,186	2,245,000	200,471	73,950	4,580,755
Louisiana		143,795	534,562	905,759	610,852			2,194,968
Maine		45,443	192,318	374,695	1,441,875	130,055		2,184,386
Maryland		406,700	550,685	381,090	843,789			2,182,264
Massachusetts	1,000	188,708	1,594,780	1,147,328	1,374,624		6,565	4,313,005
Michigan		103,047	315,332	550,161	3,605,177		518,162	5,091,879
Minnesota		422,254	637,761	1,002,483	3,540,148	50,635	369,268	6,022,549
Mississippi	6,109	226,251	522,771	596,299	2,703,982		64,587	4,119,999
Missouri		196,203	479,641	1,332,948	3,341,211	480,173	74,470	5,904,646
Montana		118,851	448,287	315,070	2,093,763		174,773	3,150,744
Nebraska		136,655	577,107	921,894	2,293,479	78,625	65,568	4,073,328
Nevada		56,964	188,316	78,809	1,877,456	239,895	83,205	2,524,645
New Hampshire		28,482	187,760	211,219	364,406	27,205	3,750	822,822
New Jersey		595,321	512,002	1,505,971	908,823		44,996	3,567,113
New Mexico		96,069	298,711	297,518	2,528,690	27,582	6,484	3,255,054
New York		470,793	1,368,216	3,350,463	7,349,032	439,390	198,811	13,176,705
North Carolina		375,718	844,042	1,073,692	3,326,302	147,736	61,677	5,829,167
North Dakota	8,230	543,115	463,928	981,803	1,597,896		47,222	3,642,194
Ohio	4,480	354,762	1,656,778	3,097,331	3,402,148	15,656		8,531,155
Oklahoma	4,542	270,028	639,448	1,415,769	3,039,910	8,986	16,343	5,395,026
Oregon		164,835	524,207	282,636	2,023,294	54,757	358,831	3,408,560
Pennsylvania		1,613,596	5,102,692	4,221,926	5,381,736	44,127	18,425	16,382,502
Rhode Island			19,460	142,021	689,151	62,008		912,640
South Carolina	7,500	237,583	485,003	788,986	2,178,118	41,049	13,716	3,751,955
South Dakota		267,176	520,159	1,124,436	1,623,124	6,021	63,711	3,604,627
Tennessee		170,166	1,193,831	1,899,771	1,523,227	12,529		4,799,524
Texas	5,501	415,240	715,205	1,137,672	8,058,319	56,500	72,354	10,460,791
Utah		49,074	348,857	265,019	1,205,765	70,407	92,817	2,031,939
Vermont		56,767	143,782	199,622	770,162	69,657	121,001	1,360,991
Virginia	3,078	444,324	406,933	1,196,245	2,413,030	23,749	82,419	4,569,778
Washington		69,657	228,445	577,496	1,953,086	108,418	149,754	3,086,856
West Virginia		254,541	301,248	999,377	867,314	12,971	58,189	2,493,640
Wisconsin		117,245	296,922	939,290	4,535,504	8,246	84,797	5,982,004
Wyoming		83,815	181,759	384,977	1,850,287	142,536	45,693	2,689,067
District of Columbia				32,054			95,905	127,959
Hawaii		93,575	224,815	91,099	367,755			777,242
Puerto Rico					242,730	79,202	22,046	343,978
Total	60,985	11,701,470	31,518,595	47,545,715	119,746,531	3,198,981	4,864,785	218,637,062

Details concerning the status of the various funds by States and by classes of highways are shown in tables 6 to 9. The mileages of highway according to status, by States, and by class of highways are shown in tables 10, 11, and 12. Similar information for grade-crossing work is shown in table 13. Tables 14, 15, and 16 show the mileage by types in the different stages leading up to completion. The tables are so arranged that each shows all funds or all mileage in a given status.

PROGRESS IN PUBLIC WORKS HIGHWAY CONSTRUCTION

This program was financed with $400,000,000 provided by the National Recovery Act and the supplementary $200,000,000 provided by the Hayden-Cartwright Act of June 1934. At the beginning of the year only a small amount of these funds remained available for construction and they did not play an important part in the year's work.

There have been completed since the beginning of the program 35,515 miles of highway, 698 railroad-highway grade separations, 86 separations of grade between highways, and 5,897 bridges, at a cost of $585,368,902 from Public Works funds. Of the roads completed, 18,339 miles, involving $274,337,625 of the Public Works funds, are on the Federal-aid system outside of municipalities; 2,670 miles, built at a cost of $160,656,990 in Public Works funds, are on extensions of the Federal-aid system into and through municipalities; and 14,506 miles, costing $150,374,287 in Public Works funds, are secondary roads. These cost figures include the cost of grade separations and bridges.

Of this mileage, 248 was completed during the year, including 116 miles on the Federal-aid system outside of municipalities, 24 miles on extensions of the system into and through municipalities, and 108 miles of secondary roads. The work completed during the year involved $8,185,691 of Public Works funds. Payments to the States for construction work in progress amounted to $11,701,470.

At the close of the year 119 miles of Public Works highways, to which $6,558,836 had been allotted, were under contract and largely under construction, and 9 miles had been approved for construction at an estimated cost to the Federal Government of $480,403 but were not yet under contract. Details concerning the funds and mileage completed, under contract, and approved for construction, but not under contract, classified according to the four classes of improvement and by States appear in tables 6, 7, 8, 10, 11, and 12.

WORKS PROGRAM HIGHWAY CONSTRUCTION

Active construction of Works Program projects under an authorization of $200,000,000 began in October 1935 and the peak activity with these funds came in 1936 and 1937. The year began with 1,765 miles under contract and largely under construction but with only a small amount available for additional work.

The year's work resulted in the completion of 1,615 miles, bringing the total mileage completed in the program to 12,904 miles. The Works Program funds involved in the completed work amounted to $177,829,247. State and other Federal funds were involved to the extent of $11,519,637.

The classes of roads completed to date and the Works Program funds used to pay the cost were as follows: On the Federal-aid highway system outside of municipalities 2,696 miles costing $44,322,677 in Works Program funds; on extensions of the Federal-aid system within municipalities, 1,033 miles costing $35,738,262 in Works Program funds; on secondary roads within municipalities, 767 miles costing $20,656,120 in Works Program funds; and secondary roads outside of municipalities, 8,408 miles costing $77,112,188 in Works Program funds.

The 372 miles under contract and largely under construction were divided as follows: 32 miles on the Federal-aid system outside of municipalities, 67 miles on extensions of the Federal-aid system through municipalities, 46 miles of secondary road within municipalities, and 227 miles of secondary road outside of municipalities. Works Program funds involved were respectively $4,512,141, $3,697,875, $1,250,709, and $3,875,798.

Similar information for projects approved for construction but not yet under contract appears in tables 8 and 12. Details for work in all stages by States is presented in tables 6 to 12.

Funds available for new work and work approved but not yet under construction totaled $3,834,231. Very little additional highway construction can be begun with Works Program funds as this program is now all but completed.

PROGRESS IN FEDERAL-AID ROAD CONSTRUCTION ON FEDERAL-AID SYSTEM

Improvement of the Federal-aid system was carried on with funds remaining from the previous fiscal year and under an authorization of $125,000,000 for 1938 provided by the act of June 16, 1936. The apportionment of this fund was shown in the last annual report.

During the year 9,101 miles of highway financed with $112,889,045 of Federal-aid funds were brought to completion. These projects involved $106,310,057 of State and emergency funds. Payments to the States for completed work, including work done on projects still under construction, amounted to $119,807,516.

At the close of the year projects under contract and in large part under construction included 9,142 miles of highway at an estimated cost of $252,161,691 to be provided as follows: $125,592,883 Federal aid, and $126,568,808 from State funds. At the same time projects had been approved, but not yet contracted for, covering 1,805 miles, and involving $25,782,883 of Federal-aid funds and $28,150,839 of State funds.

On June 30, 1938, there remained available for new projects $139,986,573 of Federal-aid funds. In greater part they were funds provided for 1939. Tables 6 to 12 show the status of the work by States.

PROGRESS IN CONSTRUCTION OF SECONDARY ROADS WITH FEDERAL AID

Improvement of secondary roads with Federal funds was first undertaken in the emergency program of road construction as a measure to relieve unemployment. Beginning with the fiscal year 1938 such work was made a part of the regular Federal-aid program and $25,000,000 was authorized for each of the fiscal years 1938 and 1939.

In the emergency program Federal funds were available to pay the full cost of construction and, since employment was the primary objective, projects for improvement were selected without delay. The new program differs in that the States are required to match the Federal funds and they must also select a system of secondary roads for improvement, not exceeding 10 percent of the highway mileage, and carefully designed to connect agricultural districts with the main highway system. Pending the selection of such a system only those secondary roads that may reasonably be expected to form part of the system are to be approved for construction. These requirements occasioned some delay in getting the program under way in a number of States.

Where State funds were insufficient to permit expenditures on secondary roads or where authority for such expenditure was lacking, arrangements had to be made with local authorities to raise required amounts and place them under State control. Now that methods of financing the States' share of the cost of secondary roads are being established and highway-planning surveys are supplying information to guide the selection of projects for improvement, it is expected that the program will go forward with a considerable gain in impetus.

In spite of these delays 713 miles were completed, 1,616 miles were under contract at the end of the year, and 905 miles were approved but not under contract, making a total of 3,234 miles. The mileage completed cost $3,581,853, the Federal Government contributing $1,880,320 of this amount. The mileage under contract was to cost $19,076,924 of which $9,616,485 is to be Federal aid. The projects approved but not under contract are estimated to cost $10,288,648 and $4,613,801 has been assigned as Federal aid. Tables 6 to 12 show the status of the work.

The cost of secondary roads in this program has varied greatly, being particularly influenced by local conditions and by availability of suitable materials. The average cost of all projects approved for construction has been $10,000 per mile.

GRADE-CROSSING ELIMINATION AND PROTECTION PROGRAM

Grade-crossing elimination work in 1938 did not equal the all-time peak established in the preceding year when 1,149 crossings were eliminated, but the record of 711 railroad-highway crossings eliminated, 144 separation structures reconstructed, and 744 crossings protected by signals or other safety devices is an important contribution to highway safety and will save much delay and inconvenience to public travel. By far the greater portion of the work done was in the emergency program of grade-crossing elimination financed by $200,000,000 authorized by the Emergency Relief Appropriation Act of 1935. In this program 663 crossings were eliminated, 133 elimination structures were reconstructed, and 603 crossings were protected. Costs were met almost entirely with Federal funds which amounted to $76,575,748. More than half of the expenditure was in municipalities, reflecting the relatively greater dangers and delays at city and suburban crossings.

In the new program of grade-crossing elimination for which $50,000,000 was authorized, 20 crossings were eliminated, 11 existing structures were reconstructed, and 43 crossings were protected. Federal funds involved in this work amounted to $1,495,583.

Since the Public Works program started in 1933, 2,556 crossings have been eliminated and 352 obsolete elimination structures have been reconstructed. The most dangerous and therefore the most important grade crossings are rapidly

being done away with in every State. The substantial program of railroad-highway grade-crossing elimination is considered one of the most advanced and productive undertakings of the present period of highway development.

At the end of the year work under contract consisted of 422 crossing eliminations, 84 elimination structures being reconstructed, and 626 crossings being protected. Table 13 shows details of the above work by States and also the number of projects approved but not under contract at the end of the year.

SUMMARY

The year's work with the funds apportioned to all States resulted in the completion of 12,129 miles of highway and the elimination of 711 railroad-highway grade crossings, the reconstruction of 144 grade separation structures and the protection of 744 crossings at a cost of $239,555,509 in Federal funds and $114,313,028 in State funds. The types of highway completed are shown in table 14.

The completed work was divided as follows: 9,333 miles on the Federal-aid system outside of municipalities, 559 miles of extensions of the system into and through municipalities, 201 miles of secondary roads in municipalities, and 2,036 miles of secondary roads outside of municipalities. Federal funds involved in the respective classes of work were $138,853,674, $40,949,891, $28,262,849, and $31,489,095.

The roads under contract at the end of the year totaled 11,486 miles and involved $203,433,345 of Federal funds, and there were 2,800 miles approved but not yet contracted for, involving $37,571,525 of Federal funds. Unobligated balances available for new work totaled $257,405,917, in large part newly apportioned funds for the fiscal year 1939. Tables 15 and 16, respectively, show the types of road under contract and the types approved but not yet under contract.

TABLE 6.—*Funds allotted to projects completed during the fiscal year 1938*

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES

State	Federal aid, 1917–33	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
			Highways	Grade crossings	Highways, 1936–39	Grade crossings		
Alabama		$27,244	$42,570		$1,646,913		$1,716,727	$3,709,289
Arizona			7,867	$40,226	1,670,771		1,718,864	2,490,537
Arkansas		2,708	32,149	190,367	2,998,127		3,223,351	3,252,570
California			377,011	576,707	3,762,771		4,716,489	7,925,716
Colorado		11,000		259,453	1,967,430		2,237,883	3,912,437
Connecticut		108,613	35,944	384,880	461,219		990,656	1,484,020
Delaware			21,120		255,680		276,800	539,741
Florida		108,370	256,690	181,000	493,993		1,040,053	1,546,093
Georgia		420,369	104,684	533,892	1,402,781		2,461,726	3,954,644
Idaho		10,820	13,500	226,122	1,560,179		1,810,621	2,961,911
Illinois			17,264	1,111,343	4,799,136		5,927,743	10,929,284
Indiana		3,000	153,394	412,564	2,837,986	$48,000	3,454,944	6,432,733
Iowa			43,373	387,234	3,281,580	137,429	3,849,616	7,511,627
Kansas			109,676	625,238	2,253,378	6,290	2,994,582	5,326,301
Kentucky		6,574	127,112	343,520	1,211,252		1,688,458	2,926,257
Louisiana			207,500	1,119,068	286,501		1,613,069	1,948,538
Maine		800	43,249	338,480	1,009,510		1,392,039	2,435,190
Maryland		19,000	131,718	9,673	524,145		684,536	1,208,721
Massachusetts			431,983	428,351	2,206,628		3,066,962	5,274,002
Michigan				462,100	2,844,502		3,306,602	6,536,160
Minnesota		81,163	6,909	132,637	2,942,308	18,111	3,181,128	6,200,301
Mississippi		210,286	225,702	926,037	1,498,758		2,860,783	4,391,468
Missouri				1,386,671	4,205,783		5,592,454	10,107,276
Montana			13,720	72,191	2,426,674		2,512,585	4,426,814
Nebraska			74,081	103,005	1,624,560		1,801,646	3,489,386
Nevada					1,927,619		1,927,619	2,310,398
New Hampshire			28,110	86,283	209,326		323,719	540,355
New Jersey		132,557		46,192	942,731		1,121,480	2,340,533
New Mexico		56,663		56,505	3,284,997		3,398,165	5,473,761
New York		97,315	55,155	2,700,669	6,695,271		9,548,410	17,853,474
North Carolina		371,841	498,445	533,643	2,697,218	43,180	4,144,327	6,844,929
North Dakota		233,667	159,107	710,379	999,312		2,102,465	2,191,489
Ohio		90,500	790,342	924,037	2,625,613		4,430,492	7,243,866
Oklahoma	$215,209	4,709	44,873	535,228	2,159,803		2,959,822	5,373,454
Oregon			380,303	250,692	2,429,590	83,178	3,143,763	4,869,519
Pennsylvania		262,779	941,662	2,689,699	6,887,610		10,781,750	18,234,628
Rhode Island		2,478	3,837	8,074	539,214		553,603	1,137,685
South Carolina		86,493		652,696	1,617,096		2,356,285	4,660,905

TABLE 6.—*Funds allotted to projects completed during the fiscal year 1938*—Contd.

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES—Continued

State	Federal aid, 1917-33	Public Works, 1934-35	Works Program		Federal aid		Total Federal funds	Estimated total cost
			Highways	Grade crossings	Highways, 1936-39	Grade crossings		
South Dakota			$242,282	$886,911	$1,412,569	$17,500	$2,559,262	$3,651,781
Tennessee			420,381	360,553	1,063,749		1,844,683	2,941,809
Texas	$52,968		167,558	277,614	7,775,423	19,700	8,293,263	16,643,120
Utah			42,927	212,531	987,457		1,242,915	1,686,658
Vermont			7,770	135,094	673,752	7,933	824,549	1,562,647
Virginia		$184,866		400,894	2,235,148		2,820,908	5,175,906
Washington				2,214	1,353,633	68,181	1,424,028	2,675,213
West Virginia		188,854	297,370	740,868	744,270		1,971,362	2,750,688
Wisconsin			186,988	467,845	3,669,315		4,324,148	8,217,489
Wyoming			57,294	183,613	1,804,304		2,045,211	3,133,420
Hawaii		169,565	8,907		412,656		591,128	1,026,795
Total	268,177	2,892,234	6,810,527	23,112,993	105,320,241	449,502	138,853,674	239,461,538

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES

Alabama		$54,028		$567,449	$53,225		$674,702	$768,325
Arizona				7,768	59,752		67,520	94,287
Arkansas		25,977	$269,125	529,907	99,910		924,919	928,338
California			216,200	256,175	148,621		620,996	792,495
Colorado					36,043		36,043	67,524
Connecticut		34,360	197,790		36,100		268,250	328,460
Delaware		3,069	195,870		7,895		206,834	215,817
Florida		134,300	69,309	258,279	246,771		708,659	963,883
Georgia		208,831	70,221	308,451	66,914		654,417	731,729
Idaho		42,124	6,218	229,642	45,491		323,475	369,347
Illinois		322,649	170	1,493,565	853,758	$17,000	2,687,142	3,746,238
Indiana			347,406	1,376,248	273,658		1,997,312	2,297,949
Iowa			375,188	796,275	301,140	19,500	1,492,103	1,922,710
Kansas			7,556	673,654	60,278		741,488	1,226,946
Kentucky			53,617	401,737	296,013		751,367	1,115,512
Louisiana			203,270	168,364			371,634	371,654
Maine			9,000	2,210	111,440		122,650	234,273
Maryland		216,800					216,800	220,454
Massachusetts		514,240	914,575	440,820	5,040		1,874,675	1,879,756
Michigan				764,500	533,781		1,298,281	1,898,906
Minnesota		160,120	64,987	154,988	382,487	191,194	953,776	1,481,860
Mississippi		9,533	326,960	362,000	177,455		875,948	1,056,051
Missouri		700,723	312,205	1,285,061	308,428		2,606,417	2,987,955
Montana					39,494		39,494	70,430
Nebraska		39,755	71,392	886,446	32,478		1,030,071	1,062,931
Nevada					124,003	35,109	159,112	180,361
New Hampshire				103,581	12,161		115,742	129,133
New Jersey			1,595,224	272,256	10,440		1,877,920	1,894,270
New Mexico			10,685	530,119	1,154		541,958	547,671
New York		491,136	675,846	1,945,246	441,068		3,553,296	4,398,912
North Carolina			291,631	306,592	126,769		724,992	865,170
North Dakota		1,490	128,789	259,357	13,413		403,049	409,722
Ohio		12,118	147,263	184,009	155,852		499,242	671,571
Oklahoma			153,046	747,872	40,783		941,701	1,004,809
Oregon		65,000	522,122	739,834	97,459	33,719	1,458,134	1,733,583
Pennsylvania		305,891	248,508	1,746,072	431,612		2,732,083	3,386,600
Rhode Island					31,260		31,260	77,528
South Carolina		167,812	242,874	289,670	133,257		833,613	1,041,885
South Dakota		6,280	76,883	322,453	21,264	19,770	446,650	464,572
Tennessee			223,723	307,640	107,954		639,317	752,150
Texas		49,645	8,041	794,510	207,665		1,059,861	1,375,829
Utah			56,518	128,441	223,049		408,008	501,053
Vermont			15,110	39,150	119,098	2,820	176,178	326,757
Virginia		30,814	150,311	381,678	107,751	50,600	721,154	838,456
Washington				273,682	85,972		359,654	441,997
West Virginia		17,240	151,868	481,546	93,539		744,193	837,851
Wisconsin			13,300		475,104		488,404	994,115
Wyoming		2,784	18,609	235,856	63,828		321,077	361,770
District of Columbia						168,320	168,320	168,320
Total		3,616,719	8,441,410	21,053,103	7,300,627	538,032	40,949,891	50,237,915

TABLE 6.—*Funds allotted to projects completed during the fiscal year 1938*—Contd.

ON SECONDARY OR FEEDER ROADS IN MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Secondary or feeder	Grade crossings		
Alabama		$37,300	$282,564			$319,864	$319,864
Arizona			6,095			6,095	6,095
Arkansas		24,781	664,085			688,866	694,880
California		316,000	1,063,353	$680		1,380,033	1,615,820
Colorado			665,124			665,124	665,124
Connecticut		44,550	350,000			394,550	415,911
Florida		28,890	110,300			139,190	139,837
Georgia		321,354	278,608			599,962	616,026
Idaho			204,352	22,010		226,362	248,819
Illinois		407,954	300,830		$2,500	711,284	713,031
Indiana		242,214	972,814		117,790	1,332,818	1,341,998
Iowa		1,981	69,861			71,842	74,377
Kansas		21,151				21,151	21,318
Kentucky		152,203	947,119	1,047		1,100,369	1,343,671
Louisiana		323,483	141,537			465,020	499,971
Maine		55,000		46,900		101,900	150,716
Maryland		85,000	10,360			95,360	95,415
Michigan			586,600			586,600	686,600
Minnesota		251,020	640,304		25,913	917,237	1,094,344
Mississippi			35,400			35,400	35,400
Missouri		165,624	1,771,128	10,212		1,946,964	1,967,586
Montana		185,240				185,240	185,267
Nebraska		244,873	131,822	4,987		381,682	386,700
Nevada		41,350	198,694			240,044	260,450
New Hampshire		65,870	168,326			234,196	234,876
New Jersey		303,530	1,562,329			1,865,859	1,865,859
New Mexico			108,236			108,236	109,216
New York		160,400	1,305,730	34,220		1,700,350	1,734,570
North Carolina		190,597	601,741	10,394		802,732	828,656
North Dakota			471,271			471,271	471,383
Ohio		826,758	305,001			1,131,759	1,182,055
Oklahoma		235,534	235,376			470,910	472,972
Oregon				552		552	904
Pennsylvania		2,220,419	770,572			2,990,991	3,435,285
Rhode Island			36,240			36,240	36,240
South Carolina			114,599			114,599	114,599
South Dakota		14,977	263,009		7,520	285,506	285,552
Tennessee		15,765	1,185,142			1,200,907	1,211,804
Texas			1,520,269			1,520,269	1,520,272
Utah		32,745	383,451		14,000	430,196	471,187
Virginia		26,909	74,544			101,453	102,444
Washington		146,371	397,851		66,593	610,815	673,016
West Virginia			298,065			298,065	298,565
Wisconsin		7,234	1,002,352			1,009,586	1,014,226
Wyoming			265,400			265,400	265,400
Total		7,197,077	20,700,454	131,002	234,316	28,262,849	29,808,301

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES

Alabama		$512,367	$233,498		$16,100	$761,965	$791,218
Arizona		80,743	96,532	$66,705		243,980	286,196
Arkansas	$32,129	100,804	140,694			273,627	276,459
California		405,197	179,396	73,086		657,679	768,338
Colorado			71,670		1,880	73,550	73,550
Connecticut		504,749	156,370			661,119	734,431
Delaware		44,195				44,195	46,948
Florida		61,200	223,125			284,325	284,675
Georgia	63,421	794,471	214,442	19,060		1,091,394	1,123,447
Idaho	1,886		59,395	128,264		189,545	321,838
Illinois	32,800	391,349	187,861	39,900		651,910	698,246
Indiana		719,431	371,041			1,090,472	1,210,804
Iowa		668,940	338,937		58,900	1,066,777	1,145,022
Kansas		359,447		12,458		371,905	384,396
Kentucky	14,079	160,050	103,796	121,526		399,451	535,286
Louisiana	319,506	176,836	195,683			692,025	714,478
Maine	12,062	241,850	172,332	66,933		493,177	578,757
Maryland		85,317	549,559			634,876	636,969
Massachusetts		666,750	1,160,788			1,827,538	1,827,546
Michigan		17,000	171,150			188,150	220,573
Minnesota	136,419	150,841	208,592			495,852	533,020
Mississippi	26,380	304,052	179,279			509,711	521,531
Missouri	229,564	244,248	162,932	457,834		1,094,578	1,608,407

TABLE 6.—*Funds allotted to projects completed during the fiscal year 1938*—Contd.

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES—Continued

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Secondary or feeder	Grade crossings		
Montana	$34,791	$141,198				$175,989	$176,578
Nebraska	31,054	157,596	$99,291	$41,669		329,610	388,615
Nevada		3,561		153,067		156,628	217,563
New Hampshire		162,290	108,103			270,393	300,464
New Jersey	303,483	272,496	592,496			1,168,475	1,191,390
New Mexico	1,770	493,344				495,114	495,704
New York		587,275	576,670	80,092		1,244,037	1,327,587
North Carolina		534,202	219,384	91,078		844,664	973,767
North Dakota		75,939	77,821			153,760	154,274
Ohio		1,423,036	609,446			2,032,482	2,068,885
Oklahoma		113,513	423,907			537,420	655,789
Oregon	17,100	89,274	126,924	74,483	$61,993	369,774	430,622
Pennsylvania	129,261	2,508,980	1,358,675	29,330		4,026,246	4,112,893
Rhode Island		2,312		58,984		61,296	125,118
South Carolina	87,800	242,667	139,716			470,183	490,573
South Dakota	9,600	209,709	174,030		6,170	399,509	399,509
Tennessee		632,904	392,419			1,025,323	1,053,526
Texas		243,161	498,703	24,545	38,100	804,509	829,604
Utah		317,452	87,220	21,346	57,000	483,018	525,642
Vermont		24,858	56,375	37,335	3,480	122,048	191,014
Virginia	106,258	120,812	341,496	27,650	30,110	626,326	673,430
Washington	5,844	34,959	99,845	61,874		202,522	298,434
West Virginia	81,531	719,230	98,320			899,081	1,018,106
Wisconsin		35,000	451,285	15,250		501,535	558,271
Wyoming		37,721		46,849		84,570	113,530
Hawaii		206,782				206,782	267,760
Total	1,676,738	16,080,108	11,709,198	1,749,318	273,733	31,489,095	34,360,783

TOTAL

State	Federal aid, 1917–33	Public Works, 1934–35	Works Program		Federal aid			Total Federal funds	Estimated total cost
			Highways	Grade crossings	Highways, 1936–39	Secondary or feeder	Grade crossings		
Alabama		$81,272	$592,237	$1,083,511	$1,700,138		$16,100	$3,473,258	$5,588,696
Arizona			88,610	150,621	1,730,523	$66,705		2,036,459	2,877,115
Arkansas		60,814	426,858	1,525,054	3,098,036			5,110,762	5,152,247
California			1,314,408	2,075,631	3,911,392	73,766		7,375,197	11,102,370
Colorado		11,000		996,247	2,003,473		1,880	3,012,600	4,718,635
Connecticut		142,973	783,033	891,250	497,319			2,314,575	2,962,822
Delaware		3,069	261,185		263,575			527,829	802,505
Florida		242,670	416,089	772,704	740,764			2,172,227	2,934,488
Georgia		692,621	1,290,730	1,335,393	1,469,695	19,060		4,807,499	6,425,846
Idaho		54,831	19,718	719,511	1,605,670	150,274		2,550,004	3,901,915
Illinois		355,449	846,737	3,093,599	5,652,894	39,900	19,500	9,978,079	16,086,800
Indiana		3,000	1,462,445	3,132,666	3,111,645		165,790	7,875,546	11,283,484
Iowa			1,089,482	1,592,307	3,582,720		215,829	6,480,338	10,653,735
Kansas			497,830	1,298,892	2,313,656	12,458	6,290	4,129,126	6,958,961
Kentucky		20,653	492,982	1,796,172	1,507,265	122,573		3,939,645	5,920,726
Louisiana		319,506	911,089	1,624,652	286,501			3,141,748	3,534,640
Maine		12,862	349,099	513,022	1,120,950	113,833		2,109,766	3,398,937
Maryland		235,800	302,035	569,592	524,145			1,631,572	2,161,559
Massachusetts		514,240	2,013,308	2,029,959	2,211,667			6,769,174	8,981,304
Michigan			17,000	1,984,350	3,378,283			5,379,633	9,242,239
Minnesota		377,702	473,757	1,136,521	3,324,796		235,218	5,547,994	9,309,524
Mississippi		246,198	856,714	1,502,717	1,676,213			4,281,842	6,004,450
Missouri		930,287	722,077	4,605,792	4,514,211	468,046		11,240,413	16,671,224
Montana		34,791	340,158	72,191	2,466,168			2,913,308	4,859,090
Nebraska		70,809	547,942	1,220,563	1,657,038	46,656		3,543,008	5,327,632
Nevada			44,911	198,694	2,051,622	153,067	35,109	2,483,403	2,968,772
New Hampshire			256,271	466,292	221,487			944,050	1,204,828
New Jersey		436,039	2,171,251	2,473,273	953,171			6,033,734	7,292,051
New Mexico		58,433	504,029	694,860	3,286,151			4,543,473	6,626,352
New York		588,451	1,478,676	6,728,314	7,136,340	114,312		16,046,093	25,314,543
North Carolina		371,841	1,514,876	1,661,360	2,823,987	101,472	43,180	6,516,716	9,512,523
North Dakota		235,157	363,835	1,518,828	1,012,725			3,130,545	3,226,868

TABLE 6.—*Funds allotted to projects completed during the fiscal year 1938*—Contd.

TOTAL—Continued

State	Federal aid, 1917–33	Public Works, 1934–35	Works Program		Federal aid			Total Federal funds	Estimated total cost
			Highways	Grade crossings	Highways, 1936–39	Secondary or feeder	Grade crossings		
Ohio		$102,618	$3,187,398	$2,022,494	$2,781,464			$8,093,974	$11,166,378
Oklahoma	$215,209	4,709	546,966	1,942,383	2,200,586			4,909,853	7,507,024
Oregon		82,100	991,699	1,117,450	2,527,049	$75,035	$178,890	4,972,223	7,034,627
Pennsylvania		697,931	5,919,569	6,565,018	7,319,221	29,330		20,531,069	29,169,404
Rhode Island		2,478	6,150	44,314	570,474	58,984		682,400	1,376,571
South Carolina		342,106	485,540	1,196,631	1,750,353			3,774,680	6,307,963
South Dakota		15,880	543,851	1,646,403	1,433,833		50,960	3,690,927	4,801,415
Tennessee			1,292,773	2,245,754	1,171,703			4,710,230	5,959,289
Texas	52,968	49,645	418,759	3,091,095	7,983,089	24,545	57,800	11,677,901	20,368,824
Utah			449,641	811,644	1,210,506	21,346	71,000	2,564,137	3,184,541
Vermont			47,738	230,619	792,849	37,335	14,233	1,122,774	2,080,417
Virginia		321,938	298,032	1,198,612	2,342,899	27,650	80,710	4,269,841	6,790,237
Washington		5,844	181,330	773,593	1,439,605	61,874	134,774	2,597,020	4,088,660
West Virginia		287,625	1,168,468	1,618,799	837,810			3,912,702	4,905,210
Wisconsin			242,522	1,921,482	4,144,419	15,250		6,323,673	10,784,101
Wyoming		2,784	113,624	684,869	1,868,132	46,849		2,716,258	3,874,120
Hawaii		169,565	215,690		412,656			797,911	1,294,555
District of Columbia							168,320	168,320	168,320
Total	268,177	8,185,691	38,529,122	76,575,748	112,620,868	1,880,320	1,495,583	239,555,509	353,868,537

TABLE 7.—*Funds allotted to projects under contract on June 30, 1938*

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways, 1936–39	Grade crossings		
Alabama	$17,000	$104,100	$60,519	$3,302,346	$32,024	$3,515,989	$6,820,773
Arizona		38,548	18,841	1,363,703	4,718	1,425,810	1,883,750
Arkansas	14,764	100,026	172,109	1,083,304	265,112	1,635,315	1,647,228
California		116,218	112,295	6,330,549	783,652	7,342,714	13,028,538
Colorado		554,697	39,474	1,383,120	37,744	2,015,035	3,159,079
Connecticut	1,970		127,600	478,086		607,656	1,101,349
Delaware		10,234	279,052	336,176	5,000	630,462	967,757
Florida	39,920	38,957	49,918	1,442,681	10,616	1,582,092	3,024,773
Georgia	259,564	319,104	872,919	3,542,571	18,346	5,012,504	8,555,076
Idaho	34,162	52,439	25,117	1,204,630	99,994	1,416,342	2,245,896
Illinois		140,310	414,858	4,751,691	478,675	5,785,534	10,499,486
Indiana	31,500	49,000	122,950	3,216,617	947,600	4,367,667	7,600,236
Iowa		74,865	84,000	3,030,138	364,000	3,553,003	7,302,122
Kansas		74,925	78,694	2,371,844	491,604	3,017,067	5,476,434
Kentucky	13,376	55,894	159,026	2,992,278	13,609	3,234,183	6,251,945
Louisiana	44,459	124,573	220,222	2,709,725	146,478	3,245,457	13,334,704
Maine		25,152	69,281	1,158,655	49,687	1,302,775	2,485,549
Maryland	131,500	291,343	343,899	1,096,021	64,586	1,927,349	3,027,509
Massachusetts		436,840	70,410	857,864	15,710	1,380,824	2,676,535
Michigan	96,788	94,521	169,432	2,474,244	479,602	3,314,587	5,807,126
Minnesota	13,041	79,000	176,500	2,327,036	73,868	2,669,445	5,029,615
Mississippi	80,143	24,339	345,433	2,926,521	107,400	3,483,836	7,591,455
Missouri	30,000	122,484	92,132	2,686,299	229,970	3,160,885	5,945,524
Montana	7,599	34,485	105,187	974,303	253,298	1,374,872	2,138,205
Nebraska		58,061	86,603	3,655,931	188,967	3,989,562	7,669,540
Nevada	6,682	33,646	13,308	1,222,535	146,452	1,422,623	1,611,210
New Hampshire		14,178	14,443	580,440	65,175	674,236	1,261,376
New Jersey	30,305	46,947	188,700	1,003,533	104,554	1,374,039	2,415,065
New Mexico		43,071	25,879	1,505,836	122,441	1,697,227	2,496,191
New York	222,900	144,795	22,000	7,625,282	1,012,700	9,027,677	16,895,064
North Carolina	8,895	50,733	192,799	3,232,277	272,900	3,757,604	7,224,521
North Dakota	216,988	43,009	48,112	2,828,614	12,046	3,148,769	3,273,874
Ohio	117,975	115,062	1,722,688	3,911,813	32,120	5,899,658	9,877,362
Oklahoma	11,446	87,560	172,271	2,741,767	17,343	3,030,387	5,563,700
Oregon	15,000	45,580	35,013	1,480,590	48,685	1,624,868	2,652,409
Pennsylvania	44,426	203,842	1,103,947	3,584,384	208,824	5,145,423	8,800,283
Rhode Island				382,966	223,897	606,863	989,829

TABLE 7.—*Funds allotted to projects under contract on June 30, 1938*—Continued

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES—Con.

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways, 1936–39	Grade crossings		
South Carolina	$99,580	$40,530	$214,539	$2,378,282	$22,137	$2,755,068	$5,745,158
South Dakota	90,681	50,997	106,996	2,293,020	96,548	2,638,242	4,475,720
Tennessee		41,923	58,560	2,497,746	14,381	2,612,610	5,110,356
Texas	174,061	179,840	162,840	6,398,356		6,915,097	13,521,758
Utah		31,007	18,461	725,404	108,143	883,015	1,171,326
Vermont		13,865	10,900	692,676	158,996	876,437	1,809,732
Virginia	2,150	90,859	55,358	2,679,032	132,725	2,960,124	5,641,708
Washington	25,090	65,824	46,426	2,471,774	124,799	2,733,823	5,001,177
West Virginia	23,168	33,471	277,876	1,085,323	214,004	1,633,842	2,205,637
Wisconsin	56,700	72,000	89,783	2,329,267	572,947	3,120,697	5,753,907
Wyoming		33,287	20,412	1,399,651	144,884	1,598,234	2,477,665
Hawaii		10,000	169,698	475,695		655,393	1,146,760
Puerto Rico				562,390	61,550	623,940	1,190,759
Total	1,961,743	4,512,141	9,067,480	113,784,986	9,080,511	138,406,861	253,582,751

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES

Alabama	$273,322		$131,700	$287,265	$81,800	$774,087	$1,069,243
Arizona				6,108		6,108	8,483
Arkansas	800		14,460	16,865	13,370	45,495	46,520
California	20,460			572,275	203,970	796,705	1,298,605
Colorado		$8,200		18,260	2,450	28,910	47,278
Connecticut			295,180	101,905		397,085	512,440
Delaware				12,109		12,109	24,834
Florida			19,820	91,850		111,670	203,520
Georgia	344,120	506,240	93,090	420,100		1,363,550	2,001,350
Idaho			1,344	18,032		19,376	31,515
Illinois	423,083		1,045,550	1,149,160	530,000	3,147,793	4,354,732
Indiana	16,400			344,013	10,400	370,813	728,306
Iowa		30,000	1,005,000	211,435	619,800	1,866,235	2,179,962
Kansas	20,885	143,071	1,110,603	576,783	203,862	2,055,204	2,746,553
Kentucky	35,261	174,680	417,814	118,950	154,478	901,183	1,020,133
Louisiana		76,360	345,820	14,460		436,640	504,639
Maine	8,645			243,889	134,770	387,304	630,183
Maryland	115,570	154,193	10,000			279,763	279,763
Massachusetts				521,581		521,581	1,043,165
Michigan		43,400	35,000	798,350	192,150	1,068,900	2,022,500
Minnesota	178,568		407,520	543,681	80,155	1,209,924	1,783,537
Mississippi	5,300	62,100	105,100	387,960	75,300	635,760	1,087,880
Missouri		640,518	12,675	208,462	155,240	1,016,895	1,281,679
Montana	40,949	60,900		8,303	107,474	217,626	224,088
Nebraska		146,793	80,551	88,181	12,108	327,633	416,441
Nevada			4,257	16,363		20,620	23,128
New Hampshire				24,960		24,960	50,011
New Jersey	76,178			421,385		497,563	938,640
New Mexico			3,129			3,129	3,129
New York	90,000	23,700	263,750	758,345		1,135,795	1,985,186
North Carolina	40,085	16,641	77,330	220,865		354,921	593,906
North Dakota	237,831	269,211		67,075	337,300	911,417	912,734
Ohio		395,780	1,609,452	509,647		2,514,879	3,069,394
Oklahoma	22,482		7,800	125,330		155,612	263,897
Oregon				160,741	276,370	437,111	540,862
Pennsylvania	102,707	586,310	1,076,115	334,043		2,099,175	2,540,093
Rhode Island				101,400		101,400	202,800
South Carolina	24,471	141,878	74,092	217,343	9,000	466,784	783,219
South Dakota	8,723	167,900	56,370	32,010	18,835	283,838	319,285
Tennessee				221,611		221,611	443,222
Texas		46,000	283,130	200,132		529,262	1,074,817
Utah				161,930	2,030	163,960	227,745
Vermont				30,925	2,400	33,325	64,250
Virginia			568,954	66,860	147,790	783,604	850,464
Washington	11,596			156,350		167,946	309,586
West Virginia	160,821		212,500	191,550	62,000	626,871	670,063
Wisconsin		4,000	42,419	1,026,190	463,840	1,536,449	2,914,009
Wyoming	17,900		90,800	2,865		111,565	113,350
Total	2,276,157	3,697,875	9,501,325	11,807,897	3,896,892	31,180,146	44,441,139

TABLE 7.—*Funds allotted to projects under contract on June 30, 1938*—Continued

ON SECONDARY OR FEEDER ROADS IN MUNICIPALITIES

State	Public Works, 1934-35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Secondary or feeder	Grade crossings		
Alabama				$3,550	$315,850	$319,400	$322,950
Arkansas			$6,475			6,475	6,475
California		$21,938			212,760	234,698	234,698
Colorado			316,470	5,630	3,550	325,650	330,150
Delaware					2,000	2,000	2,000
Florida			43,290			43,290	43,290
Georgia		363,810	517,950	12,350		894,110	906,460
Idaho				2,901		2,901	7,570
Illinois		5,600	48,922	45,100	4,500	104,122	155,626
Indiana				2,492	95,000	97,492	100,500
Iowa					3,000	3,000	3,252
Kansas				21,835	3,950	25,785	47,620
Kentucky			157,000	413	62,380	219,793	220,456
Louisiana			367,720			367,720	367,736
Maine				22,200		22,200	44,400
Maryland			72,500			72,500	72,500
Massachusetts					54,710	54,710	54,710
Michigan					247,775	247,775	247,775
Minnesota				24,898	425,833	450,731	479,443
Mississippi		34,100	21,600		70,000	125,700	125,700
Missouri			590,923	1,070		591,993	593,063
Montana			80,744		276,614	357,358	417,003
Nebraska		7,378	94,818	20,733	110,708	233,637	254,370
Nevada				166	3,309	3,475	3,501
New Jersey			161,724		100,225	261,949	261,949
New York		40,070	1,095,900	8,980		1,144,950	1,153,930
North Carolina		37,900	634,730	20,520		693,150	713,670
North Dakota		13,500	364,000		184,700	562,200	562,200
Ohio		136,809	2,038,739			2,175,548	2,578,890
Oklahoma		56,010	144,700	6,723		207,433	213,350
Oregon				678		678	1,216
Pennsylvania		208,174	285,377	8,271		501,822	557,232
South Carolina		89,055	145,857	3,100	38,500	276,512	286,209
South Dakota			9,260		45,370	54,630	54,630
Tennessee		175,890	519,850			695,740	695,740
Texas		60,475	2,920	19,255	9,250	91,900	130,543
Utah				16,580		16,580	30,520
Vermont				14,650		14,650	33,180
Virginia			3,892	1,050		4,942	5,992
Washington				40,300	250,690	290,990	327,326
West Virginia			406,400		58,900	465,300	465,300
Wisconsin			347,148	55,640		402,788	473,493
Wyoming				58,010	5,030	63,040	98,910
Total		1,250,709	8,478,909	417,095	2,584,604	12,731,317	13,685,528

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES

Alabama		$156,200	$106,600	$204,250	$154,460	$621,510	$826,034
Arizona	$19,573			192,948		212,521	308,558
Arkansas				6,563		6,563	13,126
California	71,027			474,070		545,097	901,681
Colorado		36,285		329,293	2,475	368,053	636,179
Connecticut			254,140			254,140	254,140
Delaware					70,270	70,270	70,270
Florida			59,610	10,061		69,671	79,732
Georgia	628,230	983,740	246,490	159,649		2,018,109	2,325,499
Idaho			52,614	128,808		181,422	342,741
Illinois	16,098	117,331	135,900	710,666		979,995	1,763,632
Indiana			28,293	210,308	317,913	556,514	1,000,640
Kansas		16,102		23,650		39,752	63,402
Kentucky		44,323	17,858	211,697	28,855	302,733	764,604
Louisiana	7,420	97,070		35,961		140,451	176,621
Maine		13,000		122,518	51,200	186,718	309,236
Maryland	295,516	223,048	432,075	3,132		953,771	1,047,990
Massachusetts		521,293	521,380	2,650		1,045,323	1,569,267
Michigan		185,000		11,681	25,625	222,306	233,987
Minnesota	206,861			156,529	27,020	390,410	587,149
Mississippi	120,000					120,000	120,000
Missouri				192,625		192,625	388,410
Montana	66,036	23,054		7,865		96,955	135,377
Nebraska		40,869		223,699		264,568	488,267
Nevada	15,297			303,739		319,036	365,877

TABLE 7.—*Funds allotted to projects under contract on June 30, 1938*—Continued

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES—Continued

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Secondary or feeder	Grade crossings		
New Hampshire		$87,794		$50,152		$137,946	$202,427
New Jersey			$246,680			246,680	246,680
New Mexico				330,193		330,193	541,394
New York	$16,000	79,630	52,700	1,172,150	$832,400	2,152,880	3,329,580
North Carolina	30,383	75,600	241,230	333,550	235,600	916,363	1,249,913
North Dakota	24,610	72,680			16,490	113,780	113,780
Ohio		49,680	383,812	92,200		525,692	648,830
Oklahoma	195,373	16,500		55,764		267,637	345,334
Oregon	66,468		10,000	282,524		358,992	609,566
Pennsylvania	32,701	292,870	218,128	665,390	75,086	1,284,175	2,129,081
Rhode Island				42,535		42,535	85,070
South Carolina	44,000	281,959		240,362	15,000	581,321	921,879
South Dakota	5,130	11,370	201,132	6,250	53,990	277,872	341,880
Tennessee		165,205	93,710	123,803		382,718	506,521
Texas	184,531	39,116	7,790	739,901	28,850	1,000,188	1,926,920
Utah				199,660	1,760	201,420	363,035
Vermont				73,203	46,292	119,495	218,168
Virginia	43,900	180,679		225,993	56,600	507,172	763,093
Washington	10,000		43,356	186,678	83,036	323,070	493,020
West Virginia	193,582	65,400	76,490	104,000	61,950	501,422	607,360
Wisconsin	14,200		19,537	226,835	75,000	335,572	605,325
Wyoming				175,810	9,500	185,310	294,040
Hawaii	14,000			28,125		42,125	70,250
Puerto Rico				121,950		121,950	244,000
Total	2,320,936	3,875,798	3,449,525	9,199,390	2,269,372	21,115,021	31,629,565

TOTAL

State	Public Works, 1934–35	Works Program		Federal aid			Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways, 1936–39	Secondary or feeder	Grade crossings		
Alabama	$290,323	$260,300	$298,819	$3,589,610	$207,800	$584,134	$5,230,986	$9,039,001
Arizona	19,573	38,548	18,841	1,369,811	192,948	4,718	1,644,439	2,200,791
Arkansas	15,564	100,026	193,044	1,100,169	6,563	278,482	1,693,848	1,713,349
California	91,487	138,156	112,295	6,902,824	474,070	1,200,383	8,919,215	15,463,522
Colorado		599,182	355,944	1,401,380	334,923	46,219	2,737,648	4,172,687
Connecticut	1,970		676,920	579,991			1,258,881	1,867,929
Delaware		10,234	279,052	348,285		77,270	714,841	1,064,860
Florida	39,920	38,957	172,638	1,534,531	10,061	10,616	1,806,723	3,351,315
Georgia	1,231,914	2,172,894	1,730,449	3,962,671	171,999	18,346	9,288,273	13,788,384
Idaho	34,162	52,439	79,075	1,222,662	131,709	99,994	1,620,041	2,627,722
Illinois	439,181	263,241	1,645,230	5,900,852	755,766	1,013,174	10,017,444	16,773,475
Indiana	47,900	49,000	151,243	3,560,630	212,800	1,370,913	5,392,486	9,429,682
Iowa		104,865	1,089,000	3,241,573		986,800	5,422,238	9,485,336
Kansas	20,885	234,098	1,189,297	2,948,628	45,485	699,416	5,137,809	8,334,010
Kentucky	48,637	274,897	751,698	3,111,228	212,110	259,322	4,657,892	8,257,138
Louisiana	51,879	298,003	933,762	2,724,185	35,961	146,478	4,190,268	14,383,700
Maine	8,645	38,152	69,281	1,402,543	144,718	235,657	1,898,996	3,469,368
Maryland	542,585	668,584	858,474	1,096,021	3,132	64,586	3,233,382	4,427,761
Massachusetts		958,133	591,790	1,379,445	2,650	70,420	3,002,438	5,343,676
Michigan	96,788	322,921	204,432	3,272,594	11,681	945,152	4,853,568	8,311,388
Minnesota	398,470	79,000	584,020	2,870,717	181,427	606,876	4,720,510	7,879,745
Mississippi	205,443	120,539	472,133	3,314,481		252,700	4,365,296	8,925,035
Missouri	30,000	763,002	695,730	2,894,762	193,695	385,210	4,962,399	8,208,677
Montana	114,585	118,438	185,931	982,606	7,865	637,386	2,046,811	2,914,673
Nebraska		253,101	261,972	3,744,112	244,431	311,783	4,815,399	8,828,618
Nevada	21,979	33,646	17,565	1,238,898	303,905	149,761	1,765,754	2,003,716
New Hampshire		101,972	14,443	605,400	50,152	65,175	837,142	1,513,814
New Jersey	106,483	46,947	597,104	1,424,918		204,779	2,380,231	3,862,334
New Mexico		43,071	29,008	1,505,836	330,193	122,441	2,030,549	3,040,714
New York	328,900	288,195	1,434,350	8,383,628	1,181,130	1,845,100	13,461,303	23,363,760
North Carolina	79,364	180,874	1,146,089	3,453,142	354,070	508,500	5,722,039	9,782,010
North Dakota	479,429	398,400	412,112	2,895,689		550,536	4,736,166	4,862,588
Ohio	117,975	697,332	5,754,691	4,421,461	92,200	32,120	11,115,779	16,174,476
Oklahoma	229,300	160,070	324,771	2,867,098	62,487	17,343	3,661,069	6,386,281
Oregon	81,467	45,580	45,013	1,641,331	283,202	325,055	2,421,648	3,804,053
Pennsylvania	179,834	1,291,196	2,683,567	3,918,426	673,661	283,910	9,030,594	14,026,689
Rhode Island				484,366	42,535	223,897	750,798	1,277,699
South Carolina	168,051	553,422	434,488	2,595,624	243,462	84,637	4,079,684	7,736,466

TABLE 7.—*Funds allotted to projects under contract on June 30, 1938*—Continued

TOTAL—Continued

State	Public Works, 1934–35	Works Program		Federal aid			Total Federal funds	Estimated total cost
		High-ways	Grade crossings	Highways, 1936–39	Second-ary or feeder	Grade crossings		
South Dakota	$104,534	$230,267	$373,758	$2,325,030	$6,250	$214,743	$3,254,582	$5,191,515
Tennessee		383,018	672,120	2,719,357	123,803	14,381	3,912,679	6,755,839
Texas	358,592	325,431	456,680	6,598,486	759,157	38,100	8,536,446	16,654,038
Utah		31,007	18,461	887,334	216,240	111,933	1,264,975	1,792,626
Vermont		13,865	10,900	723,601	87,853	207,638	1,043,907	2,125,330
Virginia	46,050	271,538	628,204	2,745,892	227,043	337,115	4,255,842	7,261,257
Washington	46,596	65,824	89,782	2,628,124	226,978	458,525	3,515,829	6,131,109
West Virginia	377,571	98,871	973,266	1,276,873	104,000	396,854	3,227,435	3,948,359
Wisconsin	70,900	76,000	493,887	3,355,457	282,475	1,111,787	5,395,506	9,746,734
Wyoming	17,900	33,287	111,212	1,402,516	233,820	159,414	1,958,149	2,983,965
Hawaii	14,000	10,000	169,698	475,695	28,125		697,518	1,217,010
Puerto Rico				562,390	121,950	61,550	745,890	1,434,759
Total	6,558,836	13,336,523	30,497,239	125,592,883	9,616,485	17,831,379	203,433,345	343,338,983

TABLE 8.—*Funds allotted to projects approved but not under contract on June 30, 1938*

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		High-ways	Grade crossings	Highways 1936–39	Grade crossings		
Alabama				$1,207,550	$83,400	$1,290,950	$2,501,301
Arizona				6,073		6,073	7,592
Arkansas				11,882	110,000	121,882	122,720
California				471,900	144,157	616,057	1,034,011
Colorado				207,350		207,350	372,930
Connecticut				201,510		201,510	405,970
Delaware				275,399		275,399	557,100
Florida				441,423		441,423	832,846
Georgia				794,850		794,850	1,589,700
Idaho				149,208		149,208	249,305
Illinois				1,227,000	226,000	1,453,000	2,680,000
Indiana	$29,686			472,319		502,005	976,900
Iowa				794,300		794,300	1,682,784
Kansas				1,757,860	266,363	2,024,223	3,782,086
Kentucky				949,366	169,402	1,118,768	2,068,134
Louisiana				227,491	134,100	361,591	637,353
Maine	6,550			175,247	201,130	382,927	558,175
Maryland			$130,627	287,175		417,802	720,350
Massachusetts					162,480	162,480	162,480
Michigan		$25,746		186,200	359,900	571,846	918,238
Minnesota				380,570		380,570	770,436
Mississippi	1,650			390,650	103,300	495,600	1,654,990
Missouri				1,229,376		1,229,376	3,071,600
Montana			9,240	142,262		151,502	262,596
Nebraska				375,303	13,880	389,183	766,746
Nevada				334,345		334,345	385,484
New Hampshire				47,327		47,327	94,656
New Mexico				242,840		242,840	398,170
New York			72,000	550,045	211,800	833,845	1,384,490
North Carolina				371,060		371,060	858,404
North Dakota				21,300		21,300	39,770
Ohio				1,535,997	71,710	1,607,707	3,144,125
Oklahoma				1,129,064		1,129,064	2,159,721
Oregon				1,160		1,160	1,897
Pennsylvania				766,419		766,419	1,560,338
Rhode Island			6,781	40,525		47,306	87,831
South Carolina			126,000	307,900	14,820	448,720	873,040
South Dakota				375,870	4,670	380,540	684,814
Tennessee				307,230		307,230	614,460
Texas				902,358	535,345	1,437,703	2,451,498
Utah				150,624	16,100	166,724	231,340
Vermont				107,699		107,699	246,698
Virginia				1,150,293	248,443	1,398,736	2,550,729
Washington		4,746	70,000	32,400	12,902	120,048	166,735
West Virginia				352,932	7,200	360,132	583,860
Wisconsin				708,000		708,000	1,605,672
Wyoming	26,356	20,859		38,427		85,642	109,416
Hawaii		44,644		350,440	197,540	592,624	968,150
Puerto Rico					157,920	157,920	159,001
Total	64,242	95,995	414,648	22,186,519	3,452,562	26,213,966	49,796,642

TABLE 8.—*Funds allotted to projects approved but not under contract on June 30, 1938*—Continued

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways 1936–39	Grade crossings		
Alabama				$79,585		$79,585	$165,480
Arkansas				1,080		1,080	1,320
California			$10,000	246,556		256,556	474,622
Colorado				65,390		65,390	117,630
Delaware				30,851		30,851	62,077
Florida				645,800	$178,800	824,600	1,470,400
Georgia			2,710	60,590		63,300	123,890
Idaho				228,900		228,900	382,517
Illinois	$86,286			95,351		181,637	276,987
Indiana	39,200			9,880		49,080	58,960
Iowa				78,100		78,100	164,885
Kansas		$35,200		13,426	6,600	55,226	68,652
Kentucky				160,579		160,579	321,158
Louisiana				252,661	16,750	269,411	545,926
Maryland				213,655		213,655	446,061
Massachusetts			249,991	117,225		367,216	484,441
Michigan				231,600	132,300	363,900	595,500
Minnesota				64,389	39,540	103,929	169,504
Mississippi	44,550	10,450		4,900		59,900	74,800
Missouri				21,930		21,930	48,350
Nebraska		69,610		170,740		240,350	1,671,089
Nevada				8,763		8,763	10,106
New Mexico		12,196		1,080		13,276	16,452
New York	6,000			21,550		27,550	49,100
North Carolina				22,350	17,420	39,770	62,186
North Dakota				2,318	46,140	48,458	50,470
Ohio				129,678	195,400	325,078	454,755
Oklahoma				1,489		1,489	2,800
Oregon	21,300					21,300	24,211
Pennsylvania				54,500		54,500	108,800
Rhode Island				60,410		60,410	120,820
South Carolina				7,700	291,210	298,910	309,160
South Dakota				330		330	610
Tennessee				24,500		24,500	49,000
Texas	1,952			252,029	458	254,439	521,590
Utah				45,685		45,685	64,080
Virginia	10,503	11,740	1,256	39,735		63,234	104,796
West Virginia				65,156	43,200	108,356	174,806
Wisconsin				63,700		63,700	139,068
Wyoming	570			2,203		2,773	4,139
Total	210,361	139,196	263,957	3,596,364	967,818	5,177,696	9,991,198

ON SECONDARY OR FEEDER ROADS IN MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Secondary or feeder	Grade crossings		
Alabama				$15,600		$15,600	$34,300
Colorado				19,800		19,800	35,630
Connecticut				7,190		7,190	14,380
Georgia		$6,910	$60,200	16,600		83,710	100,310
Idaho				1,181		1,181	3,702
Illinois				21,250		21,250	42,500
Indiana				150		150	300
Kentucky				557		557	1,306
Nebraska			140,000			140,000	140,000
New Jersey			44,730			44,730	44,730
New York					$227,718	227,718	228,468
North Carolina				34,400		34,400	89,900
North Dakota				1,713		1,713	3,200
Pennsylvania		4,700		1,600		6,300	7,900
South Carolina				8,100	12,814	20,914	33,934
Texas				27,307	105,000	132,307	162,129
Virginia				9,423		9,423	65,800
Washington				8,600		8,600	16,371
Wisconsin				500		500	1,353
Total		11,610	244,930	173,971	345,532	776,043	1,026,213

TABLE 8.—*Funds allotted to projects approved but not under contract on June 30 1938*—Continued

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Secondary or feeder	Grade crossings		
Alabama				$108,050		$108,050	$216,100
California				347,128		347,128	651,558
Colorado				47,570		47,570	85,560
Connecticut				16,560		16,560	33,150
Delaware		$17,000				17,000	26,712
Georgia	$73,318	69,030	$5,400	126,850		274,598	404,620
Idaho				52,309		52,309	135,681
Illinois		36,000		413,050		449,050	862,100
Indiana				338,050		338,050	741,953
Kansas				64,900		64,900	129,800
Kentucky				326,745		326,745	1,115,721
Louisiana				147,820		147,820	408,602
Maine				62,400		62,400	124,800
Maryland		69,764				69,764	70,959
Michigan				158,000		158,000	316,000
Missouri				93,420		93,420	278,080
Nebraska				90,594		90,594	191,536
Nevada	13,501			53,422		66,923	76,335
New Hampshire	20,236			74,848		95,084	226,601
New Jersey	51,847			55,855		107,702	200,390
New York				6,250		6,250	12,500
North Carolina				74,500		74,500	188,773
North Dakota				29,157		29,157	54,440
Ohio				5,000		5,000	11,100
Oklahoma				225,521		225,521	442,700
Oregon		11,846		11,850		23,696	31,270
Pennsylvania				313,876		313,876	653,552
Rhode Island				23,481		23,481	48,090
South Carolina	35,500			166,054		201,554	423,485
Tennessee	5,295			59,230		64,525	123,755
Texas		30,809		399,293	$802,100	732,202	1,313,425
Utah				17,000		17,000	32,635
Vermont					22,170	22,170	26,450
Virginia	6,103			181,547		187,650	416,623
Washington				182,600	194,071	376,671	540,803
West Virginia				59,100		59,100	118,200
Wisconsin				69,800		69,800	160,387
Wyoming				38,000		38,000	61,500
Total	205,800	234,449	5,400	4,439,830	518,341	5,403,820	10,955,946

TOTAL

State	Public Works, 1934–35	Works Program		Federal aid			Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways, 1936–39	Secondary or feeder	Grade crossings		
Alabama				$1,287,135	$123,650	$83,400	$1,494,185	$2,917,181
Arizona				6,073			6,073	7,592
Arkansas				12,962		110,000	122,962	124,040
California			$10,000	718,456	347,128	144,157	1,219,741	2,160,191
Colorado				272,740	67,370		340,110	611,750
Connecticut				201,510	23,750		225,260	453,500
Delaware		$17,000		306,250			323,250	645,889
Florida				1,087,223		178,800	1,266,023	2,353,246
Georgia	$73,318	75,940	68,310	855,440	143,450		1,216,458	2,218,520
Idaho				378,108	53,490		431,598	771,205
Illinois	86,287	36,000		1,322,350	434,300	226,000	2,104,937	3,861,587
Indiana	68,885			482,200	338,200		889,285	1,778,113
Iowa				872,400			872,400	1,847,669
Kansas		35,200		1,771,287	64,900	272,963	2,144,350	3,980,537
Kentucky				1,109,945	327,302	169,402	1,606,649	3,506,319
Louisiana				480,152	147,820	150,850	778,822	1,591,880
Maine	6,550			175,247	62,400	201,130	445,327	682,975
Maryland		69,764	130,627	500,830			701,221	1,237,370
Massachusetts			249,991	117,225		162,480	529,696	646,921
Michigan		25,746		417,800	158,000	492,200	1,093,746	1,829,738
Minnesota				444,959		39,540	484,499	939,940

TABLE 8.—*Funds allotted to projects approved but not under contract on June 30, 1938*—Continued

TOTAL—Continued

State	Public Works, 1934–35	Works Program		Federal aid			Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways, 1936–39	Secondary or feeder	Grade crossings		
Mississippi	$46,200	$10,450		$395,550		$103,300	$555,500	$1,729,790
Missouri				1,251,306	$93,420		1,344,726	3,398,030
Montana			$9,240	142,262			151,502	262,596
Nebraska		69,610	140,000	546,043	90,594	13,880	860,127	2,769,372
Nevada	13,501			343,108	53,422		410,031	471,925
New Hampshire	20,236			47,327	74,848		142,411	321,257
New Jersey	51,847		44,730		55,855		152,432	245,120
New Mexico		12,196		243,920			256,116	414,622
New York	6,000		72,000	571,595	6,250	439,518	1,095,363	1,674,558
North Carolina				393,410	108,900	17,420	519,730	1,199,263
North Dakota				23,618	30,870	46,140	100,628	147,880
Ohio				1,665,674	5,000	267,110	1,937,784	3,609,980
Oklahoma				1,130,553	225,521		1,356,074	2,605,221
Oregon	21,300	11,846		1,160	11,850		46,156	57,378
Pennsylvania		4,700		820,919	315,476		1,141,095	2,330,590
Rhode Island			6,781	100,935	23,481		131,197	256,741
South Carolina	35,500		126,000	315,600	174,154	318,844	970,098	1,639,619
South Dakota				376,200		4,670	380,870	685,424
Tennessee	5,295			331,730	59,230		396,255	787,215
Texas	1,952	30,809		1,154,387	426,600	942,903	2,556,651	4,448,643
Utah				196,309	17,000	16,100	229,409	328,055
Vermont				107,699		22,170	129,869	273,148
Virginia	16,606	11,740	1,256	1,190,028	190,970	248,443	1,659,043	3,137,948
Washington		4,746	70,000	32,400	191,200	206,973	505,319	723,909
West Virginia				418,088	59,100	50,400	527,588	876,866
Wisconsin				771,700	70,300		842,000	1,906,480
Wyoming	26,926	20,859		40,630	38,000		126,415	175,055
Hawaii		44,644		350,440		197,540	592,624	968,150
Puerto Rico						157,920	157,920	159,001
Total	480,403	481,250	928,935	25,782,883	4,613,801	5,284,253	37,571,525	71,769,999

TABLE 9.—*Balances of funds available for programmed projects on June 30, 1938*

State	Public Works, 1934–35	Works Program		Federal-aid system 1936–39	Federal aid, secondary or feeder	Federal aid, grade crossings	Total
		Highways	Grade crossings				
Alabama	$$83,316	$$2,860	$$9,575	$3,873,445	$721,522	$1,317,985	$6,008,703
Arizona	6,071	88	21,114	1,799,834	463,534	625,495	2,916,136
Arkansas	9,945	7,791	31,283	4,320,542	857,545	1,370,287	6,597,393
California	1,831	36,593	178,412	2,209,182	1,023,734	2,355,669	5,805,421
Colorado	11,371	999,932	32,161	3,038,935	519,275	1,241,823	5,843,497
Connecticut	12,988	39,576	73,681	1,522,970	294,528	844,490	2,788,233
Delaware		31,706	11,043	1,184,277	246,875	416,480	1,890,381
Florida		27,893	162,738	2,724,162	664,791	1,216,381	4,795,965
Georgia	272,391	390,655	1,677,060	5,515,965	943,117	2,399,041	11,198,229
Idaho		3,250	570	1,305,659	286,300	722,876	2,318,655
Illinois	90,488	11,990	45,644	3,272,279	836,849	3,965,468	8,222,718
Indiana	44,396	81,491	10,639	2,596,312	691,438	1,041,793	4,466,069
Iowa		6,468	85,175	1,598,050	1,298,449	1,571,017	4,559,159
Kansas		52,257	73,876	3,576,379	1,208,618	1,600,424	6,511,554
Kentucky	32,990	37,839	44,873	2,255,884	267,692	1,385,321	4,024,599
Louisiana	940	10,723	111,820	2,516,382	540,355	1,279,743	4,459,963
Maine		13,793	23,176	672,327	121,455	254,416	1,085,167
Maryland	13,801	245,743	134,200	1,992,259	409,344	962,247	3,757,594
Massachusetts	195,840	61,291	99,288	2,847,916	643,750	1,680,388	5,528,473
Michigan		6,903		3,450,087	1,365,858	1,847,833	6,670,681
Minnesota	10,245	30,072	65,536	3,528,637	1,198,153	1,775,066	6,607,709
Mississippi	4,847	20,665	98,085	3,443,858	888,927	1,228,151	5,684,533
Missouri	141,913	41,253	35,693	3,963,961	775,403	2,640,043	7,598,266
Montana	3,875		48,184	4,462,564	1,027,170	687,085	6,228,878
Nebraska	15,990	40,577	69,143	2,785,460	662,426	1,438,747	5,012,343
Nevada	1,804		6,789	1,490,200	134,117	308,880	1,941,790
New Hampshire	8	7,905	5,510	1,172,082	121,875	428,575	1,735,955
New Jersey	77,304	29,916	41,538	2,776,553	616,918	1,765,478	5,307,707

TABLE 9.—*Balances of funds available for programmed projects on June 30, 1938*—Continued

State	Public Works, 1934–35	Works Program		Federal-aid system 1936–39	Federal aid, secondary or feeder	Federal aid, grade crossings	Total
		Highways	Grade crossings				
New Mexico	$13,239	$496	$10,632	$1,134,063	$476,579	$729,050	$2,364,059
New York	113,241	524,519	269,313	4,248,388	1,171,081	4,485,311	10,811,853
North Carolina	278	1,764	178,986	3,388,863	619,115	1,918,474	6,107,480
North Dakota	13,541	34,878	59,186	3,813,287	756,382	982,545	5,659,819
Ohio	55,747	127,214	261,553	7,760,747	1,734,441	3,929,938	13,869,640
Oklahoma	4,719	17,199	108,713	3,387,789	896,907	2,264,166	6,679,493
Oregon	9,104	28,945	24,943	2,326,410	458,070	650,276	3,497,748
Pennsylvania	254,651	125,229	287,202	6,093,096	1,126,751	5,448,625	13,335,554
Rhode Island				1,158,499	121,875	269,853	1,550,227
South Carolina	3,498	1	208,529	1,866,336	261,064	1,085,621	3,425,049
South Dakota	3,277	13,983	62,527	3,442,676	816,436	1,098,084	5,436,983
Tennessee		10,076	222,383	4,938,008	876,457	1,877,652	7,924,576
Texas	37,387	49,092	129,422	8,602,515	1,938,768	4,360,065	15,117,249
Utah		34,704	25,903	1,721,289	317,130	444,955	2,543,981
Vermont		10,820	15,254	294,747	121,687	249,659	692,167
Virginia	19,321	90,884	57,121	1,119,840	473,986	1,210,472	2,971,624
Washington	714	15,216	805	1,350,405	311,791	718,301	2,397,232
West Virginia		28,417	6,418	2,518,310	386,574	876,844	3,816,563
Wisconsin			116,227	2,161,311	859,453	1,361,722	4,498,713
Wyoming		314	38,366	893,056	313,373	517,316	1,762,425
District of Columbia						325,431	325,431
Hawaii	30,788			1,198,792	218,750	296,210	1,744,540
Puerto Rico				671,985	124,925	510,830	1,307,740
Total	1,591,859	3,352,981	5,280,289	139,986,573	33,211,613	73,982,602	257,405,917

TABLE 10.—*Mileage of projects completed during the fiscal year 1938*

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES

State	Federal aid, 1917–33	Public Works, 1934–35	Works Program		Federal aid		Total
			Highways	Grade crossings	Highways, 1936–39	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama		1.0			67.9		68.9
Arizona				0.7	114.7		115.4
Arkansas			1.2	2.8	182.2		186.2
California			5.9	3.0	154.2		163.1
Colorado				1.6	133.8		135.4
Connecticut		1.1		2.0	9.4		12.5
Delaware					21.0		21.0
Florida		2.3	4.0	1.3	32.4		40.0
Georgia		21.3	7.0	5.5	154.6		188.4
Idaho			.5	1.2	206.0		207.7
Illinois				2.0	305.7		307.7
Indiana			8.6	1.7	146.0	0.1	156.4
Iowa				2.8	233.1	.9	236.8
Kansas			14.5	8.0	255.1		277.6
Kentucky			3.6	1.7	91.4		96.7
Louisiana			13.4	6.5	15.0		34.9
Maine			1.4	1.0	57.9		60.3
Maryland			3.0		14.9		17.9
Massachusetts			.8	.9	20.3		22.0
Michigan				.9	160.8		161.7
Minnesota		1.1		1.1	326.4		328.6
Mississippi		12.5	10.4	33.2	155.5		211.6
Missouri				8.5	462.6		471.1
Montana				.5	319.5		320.0
Nebraska			3.2	4.4	351.7		359.3
Nevada					128.8		128.8
New Hampshire			.5	.2	6.9		7.6
New Jersey		3.9			19.0		22.9
New Mexico		1.2		.4	365.5		367.1
New York		.5	.6	7.0	268.4		276.5
North Carolina		11.8	18.0	10.3	391.1	.4	431.6
North Dakota		36.2	12.7	33.3	184.2		266.4
Ohio		1.4	13.3	3.3	70.9		88.9
Oklahoma	23.1		4.4	3.2	216.9		247.6

TABLE 10.—*Mileage of projects completed during the fiscal year 1938*—Continued

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES—Con.

State	Federal aid, 1917–33	Public Works, 1934–35	Works Program		Federal aid		Total
			Highways	Grade crossings	Highways, 1936–39	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Oregon			2.6	1.0	166.2	1.8	171.6
Pennsylvania		6.5	21.4	12.3	197.4		237.6
Rhode Island					10.5		10.5
South Carolina		1.9		17.2	277.4		296.5
South Dakota			26.2	51.7	231.4		309.3
Tennessee			13.8	1.8	87.8		103.4
Texas	8.1		.3	1.1	1,054.5		1,064.0
Utah				1.3	138.3		139.6
Vermont				1.5	38.7		40.2
Virginia		11.8		1.7	175.3		188.8
Washington					77.7	.3	78.0
West Virginia		.7	6.3	3.3	41.8		52.1
Wisconsin			2.7	6.4	260.1		269.2
Wyoming			.1	1.1	318.0		319.2
Hawaii		1.1			13.3		14.4
Total	31.2	116.3	200.4	249.4	8,732.2	3.5	9,333.0

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES

		Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama		0.9		1.2	2.8		4.9
Arizona					.9		.9
Arkansas		.5	17.4	1.2	6.5		25.6
California			3.0	.3	4.2		7.5
Colorado					1.4		1.4
Connecticut		.3	1.7		.7		2.7
Delaware			6.0				6.0
Florida		.5	2.0	1.1	5.6		9.2
Georgia		4.7	2.3	1.1	6.7		14.8
Idaho		1.9		.7	5.8		8.4
Illinois		.2		2.1	31.2		33.5
Indiana			2.0	2.7	7.0		11.7
Iowa			.7	2.5	16.2		19.4
Kansas			.7	1.2	4.8		6.7
Kentucky			.8	2.4	3.7		6.9
Louisiana			2.0	.6			2.6
Maine			.1		4.5		4.6
Maryland		2.0					2.0
Massachusetts		.1	5.0	.7			5.8
Michigan				.5	13.1		13.6
Minnesota		1.3	2.1	1.3	25.1	1.5	31.3
Mississippi		.3	19.0	2.0	12.8		34.1
Missouri		.9	4.1	2.0	28.3		35.3
Montana					4.1		4.1
Nebraska		.4	1.0	1.7	4.9		8.0
Nevada					3.7	.2	3.9
New Hampshire				.1	.3		.4
New Jersey			4.7	.4			5.1
New Mexico				.3	.2		.5
New York		.8	5.8	1.0	13.7		21.3
North Carolina			1.4	1.3	14.9		17.6
North Dakota		.3	17.4	2.2	2.3		22.2
Ohio		.7	1.0	.5	2.8		5.0
Oklahoma			2.5	1.3	3.4		7.2
Oregon		.7	3.8	1.1	4.0	.7	10.3
Pennsylvania		3.0	2.6	4.1	8.8		18.5
Rhode Island					.8		.8
South Carolina		2.7	8.8	2.6	9.5		23.6
South Dakota			11.6	4.2	3.8		19.6
Tennessee			1.6	.9	2.5		5.0
Texas		1.0	1.1	1.7	22.2		26.0
Utah			2.5	.4	12.1		15.0
Vermont			.4	.1	5.8		6.3
Virginia		.4	2.6	5.2	5.7	.2	14.1
Washington				.3	1.8		2.1
West Virginia		.1	2.9	1.2	3.6		7.8
Wisconsin			.3		21.3		21.6
Wyoming		.3		.2	3.7		4.2
District of Columbia						.2	.2
Total		24.0	140.9	54.4	337.2	2.8	559.3

TABLE 10.—*Mileage of projects completed during the fiscal year 1938*—Continued

ON SECONDARY OR FEEDER ROADS IN MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama		1.3	0.7			2.0
Arkansas		1.2	1.2			2.4
California		5.8	1.2	1.0		8.0
Colorado			.8			.8
Connecticut		1.4	.3			1.7
Florida		2.8	.6			3.4
Georgia		7.7	1.9			9.6
Idaho			.3	9.5		9.8
Illinois		3.9	.5			4.4
Indiana		5.5	1.2		0.5	7.2
Iowa		.8	.6			1.4
Kansas		.7				.7
Kentucky		1.8	.3	.8		2.9
Louisiana		2.8	.3			3.1
Maine		1.9		6.0		7.9
Michigan			.5			.5
Minnesota		9.5	1.6			11.1
Missouri		1.7	.8	8.9		11.4
Montana		1.1				1.1
Nebraska		3.2	1.1	.3		4.6
Nevada		.3	.2			.5
New Hampshire		2.8	.1			2.9
New Jersey		1.9	2.5			4.4
New Mexico			.1			.1
New York		.5	.8	7.2		8.5
North Carolina		5.0	2.1	4.8		11.9
North Dakota			1.0			1.0
Ohio		6.2	.4			6.6
Oklahoma		6.1	.7			6.8
Oregon				.1		.1
Pennsylvania		35.8	2.1			37.9
Rhode Island			.2			.2
South Dakota		.9	1.0			1.9
Tennessee		.5	2.2			2.7
Texas			2.8			2.8
Utah		10.3	1.0		.9	12.2
Virginia		.4	.1			.5
Washington		1.2	1.2		.1	2.5
West Virginia			.8			.8
Wisconsin		.6	1.2			1.8
Wyoming			.4			.4
Total		125.6	34.8	38.6	1.5	200.5

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES

	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama		22.5	2.1			24.6
Arizona		7.3	.5	9.9		17.7
Arkansas	11.1	23.7	.4			35.2
California		11.1	.6	36.2		47.9
Colorado			.2			.2
Connecticut		14.9	.4			15.3
Delaware		10.3				10.3
Florida		3.7	10.4			14.1
Georgia	4.9	49.3	2.6	3.2		60.0
Idaho			.5	33.6		34.1
Illinois	9.3	40.3	.7	3.3		53.6
Indiana		66.0	1.6			67.6
Iowa		70.1	4.8		0.9	75.8
Kansas		20.7		24.4		45.1
Kentucky		12.5	.6	104.3		117.4
Louisiana	17.2	11.3	.7			29.2
Maine	.9	11.4	1.6	9.4		23.3
Maryland		6.6	2.9			9.5
Massachusetts		9.7	3.7			13.4
Michigan		1.4	.6			2.0
Minnesota	10.5	45.9	4.8			61.2
Mississippi	1.1	26.7	10.8			38.6
Missouri	.3	12.8	.7	237.6		251.4
Montana	.1	8.9				9.0

TABLE 10.—*Mileage of projects completed during the fiscal year 1938*—Continued

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES—Continued

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Nebraska	6.3	31.0	.5	8.6		46.4
Nevada		1.7		26.5		28.2
New Hampshire		7.7	1.3			9.0
New Jersey	1.1	12.6	1.0			14.7
New Mexico		33.8				33.8
New York		17.6	2.1	11.8		31.5
North Carolina		43.2	1.8	41.5		86.5
North Dakota		27.5	.2			27.7
Ohio		104.0	6.0			110.0
Oklahoma		16.2	2.4			18.6
Oregon	.7	3.6	.8	36.4	.2	41.7
Pennsylvania	5.2	105.3	3.8	5.9		120.2
Rhode Island				3.3		3.3
South Carolina	8.1	30.3	1.6			40.0
South Dakota	6.9	34.5	7.1			48.5
Tennessee		22.2	6.5			28.7
Texas		21.3	1.5	25.6	4.6	53.0
Utah		21.1	.8	4.8	6.4	33.1
Vermont		1.3	.2	4.3		5.8
Virginia	21.0	57.3	1.7	11.7	.9	92.6
Washington	.2	.6	.4	18.0		19.2
West Virginia	3.3	43.3	.5			47.1
Wisconsin		5.7	1.2	6.7		13.6
Wyoming		12.5		7.2		19.7
Hawaii		7.0				7.0
Total	108.2	1,148.4	92.6	674.2	13.0	2,036.4

TOTAL

State	Federal aid, 1917–33	Public Works, 1934–35	Works Program		Federal aid			Total
			Highways	Grade crossings	Highways 1936–39	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama		1.9	23.7	4.0	70.7			100.3
Arizona			7.3	1.2	115.6	9.9		134.0
Arkansas		11.7	43.5	5.6	188.7			249.5
California			25.8	5.1	158.4	37.2		226.5
Colorado				2.6	135.2			137.8
Connecticut		1.5	18.0	2.6	10.1			32.2
Delaware			16.3		21.0			37.3
Florida		2.9	12.4	13.4	38.0			66.7
Georgia		30.9	66.2	11.1	161.4	3.2		272.8
Idaho		1.9	.5	2.8	211.8	43.1		260.1
Illinois		9.5	44.2	5.2	337.0	3.3		399.2
Indiana			82.0	7.2	153.1		0.6	242.9
Iowa			71.6	10.8	249.2		1.8	333.4
Kansas			36.7	9.2	259.8	24.4		330.1
Kentucky			18.7	5.0	95.2	105.1		224.0
Louisiana		17.2	29.6	8.1	15.0			69.9
Maine		.9	14.8	2.6	62.4	15.4		96.1
Maryland		2.0	9.6	2.8	15.0			29.4
Massachusetts		.1	15.5	5.2	20.3			41.1
Michigan			1.5	2.4	174.0			177.9
Minnesota		12.9	57.4	9.0	351.3		1.6	432.2
Mississippi		13.8	56.1	46.0	168.4			284.3
Missouri		1.1	18.6	12.0	490.9	246.5		769.1
Montana		.1	10.1	.5	323.5			334.2
Nebraska		6.7	38.4	7.7	356.6	8.9		418.3
Nevada			2.0	.2	132.5	26.5	.2	161.4
New Hampshire			10.9	1.9	7.1			19.9
New Jersey		5.0	19.3	3.9	19.0			47.2
New Mexico		1.2	33.8	.8	365.7			401.5
New York		1.4	24.4	11.0	282.0	19.0		337.8
North Carolina		11.8	67.6	15.4	406.0	46.4	.4	547.6
North Dakota		36.5	57.6	36.7	186.5			317.3

TABLE 10.—*Mileage of projects completed during the fiscal year 1938*—Contd.

TOTAL—Continued

State	Federal aid, 1917–33	Public Works, 1934–35	Works Program		Federal aid			Total
			Highways	Grade crossings	Highways 1936–39	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Ohio		2.0	124.5	10.2	73.7			210.4
Oklahoma	23.1		29.2	7.7	220.2			280.2
Oregon		1.4	10.0	3.0	170.2	36.4	2.7	223.7
Pennsylvania		14.7	165.1	22.3	206.2	5.9		414.2
Rhode Island				.1	11.3	3.3		14.7
South Carolina		12.6	39.1	21.4	287.0			360.1
South Dakota		6.9	73.3	64.0	235.2			379.4
Tennessee			38.1	11.3	90.3			139.7
Texas	8.1	1.0	22.9	7.1	1,076.7	25.6	4.5	1,145.9
Utah			34.0	3.5	150.3	4.8	7.3	199.9
Vermont			1.7	1.7	44.5	4.3		52.2
Virginia		33.1	60.3	8.8	181.0	11.7	1.1	296.0
Washington		.2	1.8	1.9	79.6	18.0	.4	101.9
West Virginia		4.2	52.5	5.7	45.4			107.8
Wisconsin			9.3	8.8	281.4	6.7		306.2
Wyoming		.3	12.4	1.7	321.7	7.2		343.3
Hawaii		1.1	7.0		13.3			21.4
District of Columbia							.2	.2
Total	31.2	248.5	1,615.3	431.2	9,069.4	712.8	20.8	12,129.2

TABLE 11.—*Mileage of projects under contract on June 30, 1938*

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways, 1936–39	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama		1.3		274.2		275.5
Arizona				103.0		103.0
Arkansas		4.0	8.0	74.5	17.4	103.9
California				237.7	1.3	239.0
Colorado		2.8		79.8		82.6
Connecticut			.4	11.5		11.9
Delaware		.2	.3	18.0		18.5
Florida				68.2		68.2
Georgia	1.9	15.1	7.9	351.1		376.0
Idaho				176.3	.6	176.9
Illinois			.7	241.5	1.2	243.4
Indiana	.9			163.0	3.1	167.0
Iowa				217.0	2.5	219.5
Kansas				674.0	5.7	679.7
Kentucky			1.0	215.2		216.2
Louisiana		.1	1.1	88.2	5.7	95.1
Maine			.4	54.2	.1	54.7
Maryland	2.1	6.2	.1	37.5		45.9
Massachusetts		.5	.1	7.6		8.2
Michigan			.3	128.4	.1	128.8
Minnesota			.4	232.0	.1	232.5
Mississippi	2.6		1.0	300.2	.1	303.9
Missouri				154.6	1.7	156.3
Montana			.4	70.3	10.2	80.9
Nebraska			1.6	625.8	7.0	634.4
Nevada				93.3	.6	93.9
New Hampshire				23.1	.6	23.7
New Jersey			.3	15.2		15.5
New Mexico				201.1	14.9	216.0
New York		.2		272.2	5.9	278.3
North Carolina			.5	317.6	2.3	320.4
North Dakota	15.5			208.1		223.6
Ohio			2.2	85.5		87.7
Oklahoma		.4	.3	204.1		204.8
Oregon				92.0	.2	92.2
Pennsylvania			5.4	113.1	.7	119.2
Rhode Island				13.0	.3	13.3

TABLE 11.—*Mileage of projects under contract on June 30, 1938*—Continued

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES—Continued

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways, 1936–39	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
South Carolina	1.0		1.4	236.7	.1	239.2
South Dakota	13.1	.5	.5	361.4	.6	376.1
Tennessee				161.4		161.4
Texas				776.8		776.8
Utah				100.8	1.1	101.9
Vermont				42.4	2.1	44.5
Virginia				183.1	1.0	184.1
Washington		.7		87.3	.9	88.9
West Virginia	.1		1.1	54.4	.7	56.3
Wisconsin	.1			168.3	4.5	172.9
Wyoming				250.6	1.1	251.7
Hawaii			.5	18.6		19.1
Puerto Rico				20.5	.4	20.9
Total	37.3	32.0	35.9	8,704.4	94.8	8,904.4

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES

	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama	1.5		1.0	15.4	0.6	18.5
Arizona				.3		.3
Arkansas			.4	1.4	1.2	3.0
California				22.8	.6	23.4
Colorado				1.4		1.4
Connecticut			.5	1.7		2.2
Delaware				.7		.7
Florida				2.0		2.0
Georgia	5.8	12.8	.4	35.3		54.3
Idaho				.9		.9
Illinois	.1		.8	18.1	.7	19.7
Indiana	.2			19.3		19.5
Iowa		.3	1.5	11.0	.7	13.5
Kansas	.2	.7	1.3	14.3	1.1	17.6
Kentucky	.8	1.2	.6	4.9	.4	7.9
Louisiana		1.3	6.0	1.2		8.5
Maine				9.1	.2	9.3
Maryland	.8	1.7				2.5
Massachusetts				3.4		3.4
Michigan		.3	.1	12.1		12.5
Minnesota	.2		.3	30.6	.5	31.6
Mississippi	.1	2.5	.4	35.7	.1	38.8
Missouri		.6	.1	7.3	.8	8.8
Montana		.1		.4	.5	1.0
Nebraska		1.1	.3	12.7	.6	14.7
Nevada				.3		.3
New Hampshire				1.4		1.4
New Jersey				6.1		6.1
New York	.4	.2	.2	20.1		20.9
North Carolina		.2		17.0		17.2
North Dakota	.8	22.4		3.1	.1	26.4
Ohio		.6	1.4	10.2		12.2
Oklahoma			.1	6.2		6.3
Oregon				4.8	.5	5.3
Pennsylvania	.1	3.3	2.0	10.8		16.2
Rhode Island				1.7		1.7
South Carolina	.4	2.2	.7	21.5		24.8
South Dakota	.8	12.9	1.5	4.9		20.1
Tennessee				6.2		6.2
Texas		2.9	.6	17.7		21.2
Utah				6.2		6.2
Vermont				.5		.5
Virginia			1.3	4.3	1.0	6.6
Washington				2.1		2.1
West Virginia	2.3		.2	5.2	.5	8.2
Wisconsin				24.9		24.9
Wyoming	.6		.5	.4		1.5
Total	15.1	67.3	22.2	437.6	10.1	552.3

TABLE 11.—*Mileage of projects under contract on June 30, 1938*—Continued

ON SECONDARY OR FEEDER ROADS IN MUNICIPALITIES

State	Public Works, 1934-35	Works Program		Federal aid		Total
		Highways	Grade crossings	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama				0.7	0.7	1.4
California					.3	.3
Colorado			0.3	.4		.7
Georgia		1.34	2.0	1.5		16.9
Idaho				.1		.1
Illinois		.8	.3	4.5		5.6
Indiana				.3		.3
Kansas				.5		.5
Kentucky			.1	.4		.5
Louisiana			.7			.7
Maine				3.2		3.2
Maryland			.4			.4
Massachusetts					.1	.1
Minnesota				.8	1.9	2.7
Mississippi		1.6	.1		.1	1.8
Missouri			.3	.3		.6
Montana			.1		.2	.3
Nebraska		1.3	.6	2.0	.3	4.2
New Jersey			.2		.2	.4
New York		.1	.7	1.1		1.9
North Carolina		.5	.5	4.3		5.3
North Dakota			.1		.1	.2
Ohio		1.0	1.1			2.1
Oklahoma		4.0	.4	1.3		5.7
Oregon				.4		.4
Pennsylvania		5.6	.5	1.6		7.7
South Carolina		9.6	.9	.6		11.1
South Dakota			.4		.2	.6
Tennessee		2.0	.7			2.7
Texas		6.0		4.4	.8	11.2
Utah				1.4		1.4
Vermont				1.4		1.4
Washington				3.6	.6	4.2
West Virginia			.6		.3	.9
Wisconsin			.4	1.4		1.8
Wyoming				6.0		6.0
Total		45.9	11.4	42.2	5.8	105.3

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES

	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama		6.5	0.1	23.1	1.4	31.1
Arizona				18.6		18.6
California				52.7		52.7
Colorado		6.0		29.1		35.1
Connecticut			.6			.6
Florida			.5			.5
Georgia	6.4	80.6	7.5	42.7		137.2
Idaho			.5	12.3		12.8
Illinois	6.1	10.8	.2	113.7		130.8
Indiana			1.1	61.7	4.5	67.3
Kansas		10.2		.6		10.8
Kentucky		2.3		76.9		79.2
Louisiana	1.2	10.4		5.0		16.6
Maine		.8		15.0	1.6	17.4
Maryland	6.2	7.5	1.9			15.6
Massachusetts		.5	.5			1.0
Michigan		3.3				3.3
Minnesota	.2			44.7		44.9
Mississippi	5.2					5.2
Missouri				44.0		44.0
Montana	3.5	4.4				7.9
Nebraska		4.5		67.2		71.7
Nevada				46.2		46.2
New Hampshire		5.7		1.8		7.5
New Jersey			.9			.9
New Mexico				30.7		30.7
New York	.2	1.0	.1	146.9	1.7	149.9
North Carolina		4.9	.9	72.3	.6	78.7
North Dakota	4.0	16.2			.3	20.5
Ohio		2.2	1.5	3.7		7.4
Oklahoma	.4	1.6		8.8		10.8

TABLE 11.—*Mileage of projects under contract on June 30, 1938*—Continued

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES—Continued

State	Public Works, 1934-35	Works Program		Federal aid		Total
		Highways	Grade crossings	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Oregon	.2		.1	56.6		56.9
Pennsylvania	1.0	5.6	.3	91.1	.4	98.4
Rhode Island				3.2		3.2
South Carolina	7.7	13.1		62.5		83.3
South Dakota	6.2	.4	17.4		1.0	25.0
Tennessee		9.5	.3	12.6		22.4
Texas	.4	.1		223.9	2.2	226.6
Utah				31.6		31.6
Vermont				10.1	.7	10.8
Virginia	7.3	14.5		43.7	4.8	70.3
Washington			.5	28.0	.6	29.1
West Virginia	10.5	4.3	.5	16.5	.6	32.4
Wisconsin				22.8	.4	23.2
Wyoming				37.8		37.8
Hawaii				2.4		2.4
Puerto Rico				13.7		13.7
Total	66.7	226.9	35.4	1,574.2	20.8	1,924.0

TOTAL

State	Public Works, 1934-35	Works Program		Federal aid			Total
		Highways	Grade crossings	Highways, 1936-39	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama	1.5	7.8	1.1	289.6	23.8	2.8	326.6
Arizona				103.3	18.6		121.9
Arkansas		4.0	8.4	75.9		18.6	106.9
California				260.5	52.7	2.1	315.3
Colorado		8.8	.4	81.1	29.5		119.8
Connecticut			1.5	13.1			14.6
Delaware		.2	.3	18.6			19.1
Florida			.5	70.2			70.7
Georgia	14.1	121.8	17.8	386.5	44.2		584.4
Idaho			.6	177.2	12.3	.6	190.7
Illinois	6.2	11.6	2.0	259.6	118.1	2.0	399.5
Indiana	1.2		1.1	182.2	62.0	7.7	254.2
Iowa		.3	1.5	228.1		3.1	233.0
Kansas	.2	11.0	1.2	688.2	1.1	6.9	708.6
Kentucky	.7	3.5	1.8	220.1	77.3	.4	303.8
Louisiana	1.2	11.8	7.7	89.4	5.0	5.7	120.8
Maine		.8	.4	63.3	18.2	1.9	84.6
Maryland	9.1	15.3	2.4	37.6			64.4
Massachusetts		1.0	.6	11.0		.1	12.7
Michigan		3.6	.4	140.5		.1	144.6
Minnesota	.4		.7	262.6	45.5	2.5	311.7
Mississippi	7.9	4.0	1.5	335.9		.3	349.6
Missouri		.6	.4	161.9	44.4	2.5	209.8
Montana	3.5	4.4	.4	70.9		10.8	90.0
Nebraska		7.0	2.5	638.5	69.2	7.8	725.0
Nevada				93.7	46.1	.6	140.4
New Hampshire		5.6		24.6	1.8	.6	32.6
New Jersey			1.5	21.2		.2	22.9
New Mexico				201.1	30.7	14.9	246.7
New York	.6	1.5	1.0	292.3	148.0	7.6	451.0
North Carolina		5.6	1.8	334.7	76.6	2.9	421.6
North Dakota	20.3	38.7	.1	211.2		.5	270.8
Ohio		3.7	6.3	95.6	3.8		109.4
Oklahoma	.4	6.0	.9	210.2	10.1		227.6
Oregon	.2		.1	96.7	57.0	.7	154.7
Pennsylvania	1.2	14.4	8.1	123.8	92.8	1.2	241.5
Rhode Island				14.7	3.2	.3	18.2
South Carolina	9.1	24.9	3.0	258.2	63.1	.1	358.4
South Dakota	20.0	13.8	19.7	366.5		1.8	421.8
Tennessee		11.6	1.0	167.6	12.6		192.8
Texas	.4	9.2	.6	791.4	228.2	3.0	1,035.8
Utah				107.0	33.0	1.1	141.1

TABLE 11.—*Mileage of projects under contract on June 30, 1938*—Continued

TOTAL—Continued

State	Public Works, 1934–35	Works Program		Federal aid			Total
		Highways	Grade crossings	Highways, 1936–39	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Vermont				42.9	11.6	2.8	57.3
Virginia	7.3	14.6	1.3	187.4	43.7	6.7	261.0
Washington		.7	.5	89.5	31.6	2.1	124.4
West Virginia	12.9	4.3	2.5	59.5	16.5	2.1	97.8
Wisconsin	.1		.3	193.3	24.2	4.9	222.8
Wyoming	.6		.5	251.0	43.8	1.1	297.0
Hawaii			.5	18.6	2.4		21.5
Puerto Rico				20.5	13.7	.4	34.6
Total	119.1	372.1	104.9	9,142.0	1,616.4	131.5	11,486.0

TABLE 12.—*Mileage of projects approved but not under contract on June 30, 1938*

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways, 1936–39	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama				111.8	0.2	112.0
Arkansas				4.0	.5	4.5
California				20.7	.4	21.1
Colorado				9.5		9.5
Connecticut				3.6		3.6
Delaware				4.7		4.7
Florida				19.8		19.8
Georgia				76.9		76.9
Idaho				15.7		15.7
Illinois				76.9	.7	77.6
Indiana	0.3			10.4		10.7
Iowa				63.6		63.6
Kansas				215.2	8.6	223.8
Kentucky				37.0	1.0	38.0
Louisiana				1.8	7.4	9.2
Maine	.1			6.4	4.7	11.2
Maryland			0.4	11.1		11.5
Massachusetts					.6	.6
Michigan				7.1	4.2	11.3
Minnesota				78.8		78.8
Mississippi				80.0	.1	80.1
Missouri				126.6		126.6
Montana			.1	8.3		8.4
Nebraska				64.7	2.5	67.2
Nevada				64.1		64.1
New Hampshire				1.4		1.4
New Mexico				38.0		38.0
New York				12.7	.4	13.1
North Carolina				54.6		54.6
North Dakota				8.0		8.0
Ohio				20.3	1.4	21.7
Oklahoma				68.9		68.9
Pennsylvania				21.2		21.2
Rhode Island				.3		.3
South Carolina			.5	35.7		36.2
South Dakota				66.1	.5	66.6
Tennessee				16.1		16.1
Texas				86.8	11.9	98.7
Utah				21.5		21.5
Vermont				6.7		6.7
Virginia				63.1	.5	63.6
Washington			.6	.3		.9
West Virginia				11.4	.1	11.5
Wisconsin				51.1		51.1
Wyoming				7.6		7.6
Hawaii		0.7		8.7	1.6	11.0
Puerto Rico					.6	.6
Total	.4	.7	1.6	1,719.2	47.9	1,769.8

TABLE 12.—*Mileage of projects approved but not under contract on June 30, 1938*—Continued

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways, 1936–39	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama				7.2		7.2
California			0.2	2.9		3.1
Colorado				1.3		1.3
Delaware				.4		.4
Florida				.7	0.2	.9
Georgia				9.0		9.0
Idaho				.3		.3
Illinois				4.2		4.2
Indiana	0.4			.3		.7
Iowa				1.8		1.8
Kansas		0.3		.7	.2	1.2
Kentucky				2.6		2.6
Louisiana				.3	2.0	2.3
Maryland				.2		.2
Massachusetts			.4	2.2		2.6
Michigan				3.2	.8	4.0
Minnesota				6.3		6.3
Mississippi	.5	.1		1.3		1.9
Missouri				1.8		1.8
Nebraska		1.8		4.8		6.6
New Mexico				.2		.2
New York				.7		.7
North Carolina				.9	.1	1.0
North Dakota				.8	.6	1.4
Ohio				1.2	.1	1.3
Oklahoma				.5		.5
Oregon	.2					.2
Pennsylvania				1.4		1.4
Rhode Island				1.0		1.0
South Carolina				1.2	.6	1.8
South Dakota				.1		.1
Tennessee				.5		.5
Texas				7.8		7.8
Utah				8.0		8.0
Virginia	.3	.2		2.5		3.0
West Virginia				1.5	.3	1.8
Wisconsin				5.5		5.5
Wyoming				.3		.3
Total	1.4	2.4	.6	85.6	4.9	94.9

ON SECONDARY OR FEEDER ROADS IN MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Secondary or feeder	Grade crossings	
		Miles	*Miles*	*Miles*	*Miles*	*Miles*
Alabama				1.9		1.9
Colorado				.4		.4
Connecticut				.3		.3
Georgia		0.4	0.2	4.6		5.2
Idaho				.5		.5
Illinois				4.8		4.8
Indiana				.1		.1
Kentucky				.3		.3
Nebraska			.6			.6
New Jersey			.1			.1
New York					0.1	.1
North Carolina				10.3		10.3
North Dakota				.5		.5
Pennsylvania		.2				.2
South Carolina				1.9		1.9
Texas				4.3	.3	4.6
Virginia				.3		.3
Washington				1.7		1.7
Wisconsin				.1		.1
Total		.6	.9	32.0	.4	33.9

TABLE 12.—*Mileage of projects approved but not under contract on June 30, 1938*—Continued

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama				18.2		18.2
California				28.2		28.2
Colorado				3.6		3.6
Connecticut				.6		.6
Delaware		4.4				4.4
Georgia	0.5	4.3	0.1	27.8		32.7
Idaho				32.2		32.2
Illinois				70.8		70.8
Indiana				65.8		65.8
Kansas				25.7		25.7
Kentucky				104.9		104.9
Louisiana				28.5		28.5
Maine				6.7		6.7
Maryland		1.6				1.6
Michigan				26.3		26.3
Missouri				31.1		31.1
Nebraska				38.7		38.7
Nevada	1.7			7.9		9.6
New Hampshire				3.9		3.9
New Jersey	1.1			1.9		3.0
New York				.1		.1
North Carolina				10.9		10.9
North Dakota				8.5		8.5
Ohio				.9		.9
Oklahoma				39.7		39.7
Oregon		.9		2.1		3.0
Pennsylvania				36.9		36.9
Rhode Island				2.9		2.9
South Carolina	1.4			46.7		48.1
Tennessee	2.6			2.6		5.2
Texas		8.6		124.1	0.6	133.3
Utah				1.6		1.6
Vermont					.2	.2
Virginia				21.8		21.8
Washington				30.9	.4	31.3
West Virginia				9.4		9.4
Wisconsin				6.4		6.4
Wyoming				5.1		5.1
Total	7.3	19.8	.1	873.4	1.2	901.8

TABLE 12.—*Mileage of projects approved but not under contract on June 30, 1938*—Continued

TOTAL

State	Public Works, 1934–35	Works Program		Federal aid			Total
		Highways	Grade crossings	Highways, 1936–39	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama				118.9	20.1	0.2	139.2
Arkansas				4.0		.5	4.5
California			0.2	23.6	28.2	.4	52.4
Colorado				10.9	4.0		14.9
Connecticut				3.6	.9		4.5
Delaware		4.4		5.1			9.5
Florida				20.5		.2	20.7
Georgia	0.5	4.7	.4	85.9	32.3		123.8
Idaho				16.0	32.7		48.7
Illinois				81.1	75.5	.7	157.3
Indiana	.7			10.7	65.9		77.3
Iowa				65.4			65.4
Kansas		.3		216.0	25.7	8.8	250.8
Kentucky				39.5	105.3	1.0	145.8
Louisiana				2.1	28.4	9.4	39.9
Maine	.1			6.4	6.7	4.7	17.9
Maryland		1.6	.4	11.3			13.3
Massachusetts			.4	2.2		.6	3.2
Michigan				10.3	26.2	5.0	41.5
Minnesota				85.1			85.1
Mississippi	.6	.1		81.1		.1	81.9
Missouri				128.4	31.1		159.5
Montana			.1	8.3			8.4
Nebraska		1.8	.6	69.5	38.7	2.5	113.1
Nevada	1.7			64.1	7.9		73.7
New Hampshire				1.4	3.9		5.3
New Jersey	1.0		.1		1.9		3.0
New Mexico				38.2			38.2
New York				13.4	.1	.5	14.0
North Carolina				55.6	21.3	.1	77.0
North Dakota				8.8	9.0	.5	18.3
Ohio				21.6	.9	1.5	24.0
Oklahoma				69.4	39.7		109.1
Oregon	.2	1.0			2.0		3.2
Pennsylvania		.2		22.5	36.9		59.6
Rhode Island				1.2	3.0		4.2
South Carolina	1.4		.5	36.8	48.7	.7	88.1
South Dakota				66.2		.5	66.7
Tennessee	2.6			16.7	2.6		21.9
Texas		8.6		94.6	128.4	12.8	244.4
Utah				29.5	1.6		31.1
Vermont				6.7		.2	6.9
Virginia	.3	.2		65.6	22.1	.5	88.7
Washington			.5	.3	32.6	.5	33.9
West Virginia				13.1	9.4	.3	22.8
Wisconsin				56.5	6.6		63.1
Wyoming				7.9	5.1		13.0
Hawaii		.6		8.8		1.6	11.0
Puerto Rico						.6	.6
Total	9.1	23.5	3.2	1,804.8	905.4	54.4	2,800.4

TABLE 13.—*Status of grade-crossing elimination and protection projects on June 30, 1938*

COMPLETED DURING FISCAL YEAR

State	Crossings eliminated						Separation structures reconstructed			Crossings protected					
	Public Works, 1934-35	Works Program		Federal aid		Total	Works Program grade crossings	Federal-aid grade crossings	Total	Public Works, 1934-35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways, 1936-39	Grade crossings						Highways	Grade crossings	Highways, 1936-39	Grade crossings	
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Alabama			11		1	12									
Arizona			2			2						5			5
Arkansas			16			16	2		2			29			29
California			16			16									
Colorado			9			9	2		2			21		1	22
Connecticut			6			6						1			1
Florida	1		12			13	1		1			29			29
Georgia	1		25	1		27	4		4	1		24			25
Idaho			9	1		10	1		1			13			13
Illinois	1		15	1		17	5	2	7	63					63
Indiana			20	3	2	25	1		1	19		130			149
Iowa			28		4	32	2	3	5			1		1	2
Kansas			11			11					1	3		3	7
Kentucky			9			9	6		6	4					4
Louisiana			16			16	2		2						
Maine			5			5	2		2			2			2
Maryland			4			4	1		1			16			16
Massachusetts			14	3		17	2		2				4		4
Michigan			6			6	2		2						
Minnesota			11		1	12	2		2			14	1	16	31
Mississippi			23			23	3		3	2		19			21
Missouri			29	1		30	1		1						
Montana			1			1									
Nebraska			15			15	1		1			16			16
Nevada			1			1		1	1						
New Hampshire			7			7	1		1			6			6
New Jersey	1		14			15	5		5						
New Mexico			7			7				1					1
New York	4	1	16	1		22	26		26						
North Carolina			26			26	3		3						
North Dakota			28			28	2		2						

Ohio			16			16	7		7			11			11
Oklahoma			19			19	8		8			38			38
Oregon			7		3	10	1		1						
Pennsylvania			36	1		37	10		10						
Rhode Island							1		1						
South Carolina			21			21	7		7			39			39
South Dakota			35			35	2		2			26		15	41
Tennessee			28			28	1		1			19			19
Texas			27	1	3	31	2		2			107			107
Utah			13		2	15								2	2
Vermont			3			3	2		2			5		5	10
Virginia			14		2	16	8	3	11	1		14			15
Washington			2	2	2	6	2	1	3		1	3			4
West Virginia			15			15	3		3			2			2
Wisconsin			10	4		14	2		2			10			10
Wyoming			5			5									
District of Columbia								1	1						
Total	8	1	663	19	20	711	133	11	144	91	2	603	5	43	744

UNDER CONTRACT

Alabama			4		8	12								6	6
Arkansas			3		7	10						2			2
California				1	3	4		4	4	47					47
Colorado			3		1	4								4	4
Connecticut			4			4									
Delaware			2			2								23	23
Florida			1	1		2						45			45
Georgia	1		22			23	13		13			33			33
Idaho			1		1	2						1			1
Illinois	1		13	2	8	24							1	1	2
Indiana			1		6	7		6	6			32		86	118
Iowa			8		12	20		1	1					21	21
Kansas			5		12	17	1		1					6	6
Kentucky			3		1	4	3		3	5				31	36
Louisiana			7	2	2	11	1		1				1		1
Maine			1		2	3		2	2					1	1
Maryland	1		5		1	7	1		1			13			13
Massachusetts		1	2			3		1	1						
Michigan			1		8	9	1	1	2					45	45
Minnesota			3		2	5		5	5					1	1
Mississippi			4		3	7	2		2			3			3
Missouri		1	5		6	12									
Montana			1		6	7	1		1						
Nebraska			2		11	13									
Nevada				1		1		3	3			5		2	7
New Hampshire								1	1			1			1
New Jersey			3	1	2	6	2	1	3						

TABLE 13.—*Status of grade-crossing elimination and protection projects on June 30, 1938*—Continued

UNDER CONTRACT—Continued

State	Crossings eliminated						Separation structures reconstructed			Crossings protected					
	Public Works, 1934-35	Works Program		Federal aid		Total	Works Program grade crossings	Federal-aid grade crossings	Total	Public Works, 1934-35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways, 1936-39	Grade crossings						Highways	Grade crossings	Highways, 1936-39	Grade crossings	
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
New Mexico					4	4						1			1
New York			7		8	15	2	4	6					2	2
North Carolina			12		4	16		2	2			115			115
North Dakota					1	1	1	2	3						
Ohio			40			40						1			1
Oklahoma			2	1		3									
Oregon			1		1	2		2	2						
Pennsylvania			15	1	2	18	5		5						
Rhode Island					1	1									
South Carolina	1		4			5	4	1	5			6		22	28
South Dakota			21		3	24		1	1					10	10
Tennessee			4			4	1		1			1			1
Texas			1		2	3						5			5
Utah					2	2								4	4
Vermont					6	6		1	1					1	1
Virginia			4		12	16		2	2			1		3	4
Washington			1	1	5	7		3	3					4	4
West Virginia			12		4	16						1		3	4
Wisconsin			1	4	10	15	1		1			24			24
Wyoming			1			1		2	2					6	6
Hawaii			2			2									
Puerto Rico					2	2									
Total	4	2	232	15	169	422	39	45	84	52		290	2	282	626

State	Crossings eliminated					Separation structures reconstructed		
	Public Works 1934–35	Works Program grade crossings	Federal aid		Total	Works Program grade crossings	Federal-aid grade crossings	Total
			Highways, 1936–39	Grade crossings				
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Alabama				1	1			
Arkansas				1	1			
California		5		1	6			
Florida				1	1			
Georgia		1			1			
Illinois	1			2	3			
Kansas				5	5			
Kentucky				2	2			
Louisiana			1	4	5			
Maine				3	3			
Maryland						1		1
Massachusetts		1		1	2			
Michigan				4	4			
Minnesota							1	1
Mississippi				1	1			
Montana						1		1
Nebraska		1		2	3			
New Jersey						1		1
New York							3	3
North Carolina							2	2
North Dakota				1	1			
Ohio				4	4			
South Carolina				2	2	2	1	3
Texas			1	9	10		2	2
Utah				1	1			
Vermont							1	1
Virginia				2	2			
Washington		1	1	3	5			
West Virginia			1		1			
Hawaii				3	3		1	1
Puerto Rico				2	2			
Total	1	9	4	55	69	5	11	16

TABLE 14.—*Mileage, by types of construction, of projects completed during the fiscal year 1938*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Grade separations		Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							Railroad and highways	Between highways	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama	12.3	4.3	18.4	7.7	50.3						0.8		6.2	0.3		100.3
Arizona				20.0	78.5			26.5			8.4		.6			134.0
Arkansas	25.8			24.9	.7		1.8	120.5		2.9	71.4		.9	.6		249.5
California					24.7			118.4		42.9	39.0		1.0	.5		226.5
Colorado				116.8				4.4		.1	14.5		.9	1.1		137.8
Connecticut					17.5				9.5	1.6	3.3		.2	.1		32.2
Delaware				10.3						10.3	16.7					37.3
Florida	33.1		.4				10.9			.1	21.7		.2	.3		66.7
Georgia	9.2	7.4	32.1	58.7	51.9		51.0				59.0	0.8	1.7	1.0		272.8
Idaho	19.9			90.2				139.3	4.1	.3	5.4		.3	.6		260.1
Illinois	119.6			12.5		79.4	14.9	3.6		.2	165.6		2.7	.7		399.2
Indiana	77.7			24.5	6.5		20.0	9.5		4.0	97.5		.9	2.3		242.9
Iowa	75.2			6.9							249.0		1.2	1.1		333.4
Kansas	28.4	13.2		187.9				37.0			61.3		1.8	.5		330.1
Kentucky	10.0			137.7				17.3		4.3	53.5		1.0	.2		224.0
Louisiana	17.1		4.6	14.3	1.0						30.5		.9	1.5		69.9
Maine				15.7	44.4				19.0	14.8	2.0			.2		96.1
Maryland				6.5			.9			.5	21.2		.2	.1		29.4
Massachusetts								1.3	9.9	26.9			.1	2.8	0.1	41.1
Michigan				12.6						13.8	150.7	.3	.4	.1		177.9
Minnesota	108.5			80.7	24.5			114.5		2.1	101.4		.3	.2		432.2
Mississippi	119.1		8.9	38.5	2.3					9.1	104.2		1.8	.4		284.3
Missouri	37.9			231.8	266.7			23.9		23.7	181.2		2.4	1.5		769.1
Montana	50.6			136.5	49.1			96.2					1.7	.1		334.2
Nebraska	32.4	53.9	22.1					270.7			37.0		1.1	1.1		418.3
Nevada			.8	39.9	5.0			109.8		5.6			.3			161.4
New Hampshire							14.3	1.1	3.2	.1	.9		.2	.1		19.9
New Jersey				10.1	1.1				4.3	2.4	28.0		.2	1.0	.1	47.2
New Mexico	37.1			108.6	78.5			175.0			.4		1.9			401.5
New York	6.1			6.0	41.5				21.8	65.1	193.0	.3	1.3	2.6	.1	337.8
North Carolina	21.6	56.1	172.9	47.6	85.3		4.7	54.7		9.4	93.8		1.2	.3		547.6
North Dakota	55.1			105.4	54.1			101.2			.4	.3	.1	.7		317.3
Ohio	15.1			99.9	.4	3.1	2.4			17.2	38.8	32.1	.9	.5		210.4
Oklahoma	24.8			106.4	5.6					27.9	112.9		1.8	.8		280.2
Oregon	6.8			11.7	71.4	.2	11.2	27.7	59.7	14.2	19.6		.6	.6		223.7
Pennsylvania	4.6			74.9					61.1	39.2	225.6	6.2	1.5	.8		414.2

Rhode Island					2.9				1.0	2.2	8.6					14.7
South Carolina	41.0	29.1	246.7	3.8				5.9		14.5	17.7		.9	.5		360.1
South Dakota	112.9			53.8	58.8			100.1			52.9		.4	.5		379.4
Tennessee	2.9			65.2					5.3	12.9	49.7	2.0	1.0	.7		139.7
Texas	270.9			146.0	417.0		10.9			21.4	268.5	3.0	7.6	.6		1,145.9
Utah	1.7			65.9	5.7			112.9		6.3	6.9		.2	.3		199.9
Vermont				.3	12.4		1.6	23.4	2.6		11.6		.2	.1		52.2
Virginia	5.9		28.0	52.5	31.0		139.3			9.3	24.0		.9	5.1		296.0
Washington	3.7			53.3				9.0	6.1	2.3	25.5		.9	1.1		101.9
West Virginia	38.0			7.7		5.0	18.5	5.9		10.2	21.2		.5	.8		107.8
Wisconsin	44.4			71.8				13.1		.9	174.5		.8	.7		306.2
Wyoming	35.8			30.0	9.9			266.2					.7	.7		343.3
Hawaii	.9				1.6		13.2		5.3				.4			21.4
District of Columbia										.2						.2
Total	1,506.1	164.0	534.9	2,395.5	1,500.3	87.7	315.9	1,989.1	212.9	418.9	2,869.8	45.0	53.0	35.8	.3	12,129.2

TABLE 15.—*Mileage, by types of construction, of projects under contract on June 30, 1938*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Grade separations		Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							Railroad and highways	Between highways	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama		7.1	175.0	7.3	131.3		1.5			0.2	1.9		2.1	0.2		326.6
Arizona				6.7	61.4			53.1					.7			121.9
Arkansas	30.2			5.1				68.5			2.6		.3	.2		106.9
California	1.8			14.8	21.9			125.0	14.7	78.8	57.9		2.8	.6		315.3
Colorado	4.1			117.9						.3			.5			119.8
Connecticut					.3		7.0		.9		6.2			.2		14.6
Delaware										.2	18.7			.2		19.1
Florida	39.9				6.3		.4	1.3			21.9		.9			70.7
Georgia	9.8	31.6	90.8	94.1	173.4		90.7			23.5	66.3		3.4	.8		584.4
Idaho	7.8			59.5				118.2		.1	4.8		.2	.1		190.7
Illinois	100.6	8.1		25.8	6.1	118.8		19.0		3.1	111.7	1.5	3.7	4.1		389.5
Indiana	21.0			26.9				37.4		40.7	126.9		1.0	.3		254.2
Iowa	37.6			.6							193.1		.6	1.1		233.0
Kansas	14.4		21.2	63.2	473.5			98.6			33.0		2.5	2.2		708.6
Kentucky	10.6			93.2				89.9		20.3	88.4		1.1	.3		303.8
Louisiana	63.0			5.0							48.5		3.9	.3	0.1	120.8
Maine				.8	39.0		16.9		10.3	10.5	7.0		.1			84.6
Maryland	1.5			3.1		.3			6.3	.6	52.2		.4	.3		64.4
Massachusetts	1.9							.6	1.7	7.3	.5		.3	.4		12.7
Michigan	13.4			8.8						14.4	107.3		.6	.1		144.6
Minnesota	28.8	9.6		17.5	15.6			202.7			36.5		.3	.6	.1	311.7
Mississippi	42.1			5.4	16.6						284.1		.7	.7		349.6
Missouri	33.9			76.2	46.3					5.7	44.5		2.2	.8	.2	209.8
Montana	21.5			23.0				44.6			.2		.6	.1		90.0
Nebraska	86.8	87.1	242.3					244.0			56.3		8.1	.4		725.0
Nevada				88.6				54.7						.1		146.4
New Hampshire							20.8	5.0		3.5	3.1		.2			32.6
New Jersey	2.4				.8					.3	19.3			.1		22.9
New Mexico	14.8			93.6	15.7			121.3					1.3			246.7
New York	52.7			5.7	134.6		5.4	16.2	13.5	25.8	195.2		1.3	.6		451.0
North Carolina	64.9	.7	124.9	17.8	87.0		9.5	57.6		2.8	54.5		4.7	.2		421.6
North Dakota	88.3	.3		19.7	47.3			114.4			.4		.4			270.8
Ohio	.5			14.6		2.4	.1			15.3	47.2	31.0	.6	.7		109.4
Oklahoma	15.9			125.7	2.3			13.1	6.3	3.3	58.0		2.3	.7		227.6
Oregon	5.9			52.1	64.8		7.1		5.7	4.2	13.9		.9	.1		154.7
Pennsylvania				45.9			18.1		44.5	56.7	72.9	1.9	.7	.8		241.5
Rhode Island								3.2	3.7	5.2	6.1					18.2

South Carolina	11.5	28.5	208.7		41.1			17.7		23.0	25.7		2.0	.2		358.4
South Dakota	199.7			7.0	67.0			147.1					.8	.2		421.8
Tennessee				75.7						54.9	60.8		1.0	.4		192.8
Texas	234.6			187.6	351.3			8.5		88.1	142.0	14.6	8.4	.6	.1	1,035.8
Utah	.2			43.9	8.9			74.0		4.2	9.9					141.1
Vermont				.6	14.2			39.2			3.1		.1	.1		57.3
Virginia	3.0	5.7	48.8	10.2	27.4		61.5			31.6	71.3		1.1	.4		261.0
Washington	4.0			87.4				14.0		.2	17.0		1.5	.3		124.4
West Virginia	8.8			5.6			12.0	26.8		28.4	15.2		.1	.9		97.8
Wisconsin	85.7			72.0				6.6		.3	56.8		1.2	.2		222.8
Wyoming	113.7			25.2				157.4					.6	.1		297.0
Hawaii							20.8		.4				.3			21.5
Puerto Rico							34.2						.2	.2		34.6
Total	1,474.3	178.7	908.7	1,627.8	1,854.1	121.5	306.0	1,976.7	108.0	553.5	2,242.9	49.0	66.4	17.9	.5	11,486.0

TABLE 16.—*Mileage, by types of construction, of projects approved but not under contract on June 30, 1938*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Grade separations		Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							Railroad and highways	Between highways	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama			44.8	13.5	79.8						0.2		0.9			139.2
Arkansas				4.0							.4			0.1		4.5
California	4.6		1.0	2.4	5.5			29.4		5.7	3.5		.3			52.4
Colorado				14.4							.4		.1			14.9
Connecticut							0.8		0.9		2.8					4.5
Delaware	4.5									3.4	1.4		.2			9.5
Florida	7.2						6.2				6.8		.5			20.7
Georgia	13.7	16.3	24.8	13.0	11.0	2.1	11.8			17.8	12.6		.6	.1		123.8
Idaho				9.5				38.9					.3			48.7
Illinois	33.9			27.5		53.0		8.3			34.3		.1		0.2	157.3
Indiana	9.0			19.3	3.4			34.2			11.4					77.3
Iowa	8.4				17.0						39.7		.3			65.4
Kansas	78.7		13.7	66.8	54.8			18.0			17.8		1.0			250.8
Kentucky	8.8			102.3				5.0		6.8	21.8		1.0	.1		145.8
Louisiana	9.3			28.0							1.6		.8	.2		39.9
Maine					3.1		10.7		3.4	.2	.5					17.9
Maryland	1.8			.7							10.7				.1	13.3
Massachusetts									.4	2.8						3.2
Michigan	8.5			12.1				7.1		3.0	10.8					41.5
Minnesota	10.3	4.2		.2	13.4			57.0								85.1
Mississippi	51.1										30.0		.7	.1		81.9
Missouri	17.0			42.1	46.3		34.1				19.7		.3			159.5
Montana	8.3							.1								8.4
Nebraska	15.8	38.6	42.7					9.9			4.5		.9	.7		113.1
Nevada				12.8				60.9								73.7
New Hampshire							4.3			1.0						5.3
New Jersey										1.1	1.8		.1			3.0
New Mexico				11.2				26.8					.2			38.2
New York	3.8			.1							10.1					14.0
North Carolina	3.2		7.1		39.1			18.4			9.1		.1			77.0
North Dakota		9.0						9.3								18.3
Ohio				.9			6.1				7.2	9.4	.1	.2	.1	24.0
Oklahoma	7.9			73.3						9.7	16.5		1.7			109.1
Oregon				1.0			2.0			.1	.1					3.2
Pennsylvania				27.7					12.5	2.8	16.6					59.6
Rhode Island									2.9	.9	.4					4.2
South Carolina	10.6	14.7	59.8							2.3	.3		.2	.2		88.1

South Dakota	45.0							21.6					.1			66.7
Tennessee				5.0						.9	15.8		.2			21.9
Texas	66.6			46.7	104.2			4.3		16.2	2.8		2.2	1.4		244.4
Utah				5.7				24.8			.6					31.1
Vermont					.2			6.7								6.9
Virginia	2.7		13.4	5.0	18.0	.1	21.9			11.1	16.0		.4	.1		88.7
Washington				22.3	11.1					.5						33.9
West Virginia					4.9		4.5			7.1	5.7		.1	.5		22.8
Wisconsin	1.3			25.0							36.6		.2			63.1
Wyoming	5.0							7.9					.1			13.0
Hawaii							10.2		.6				.2			11.0
Puerto Rico							.4							.2		.6
Total	437.0	82.8	207.3	592.5	411.8	55.2	113.0	388.6	20.7	93.4	370.5	9.4	13.9	3.9	.4	2,800.4

CONSTRUCTION OF ROADS THROUGH PUBLIC LANDS AND FEDERAL RESERVATIONS

Special authorizations and appropriations have been made by Congress for the survey, construction, reconstruction, and maintenance of main roads through unappropriated or unreserved public lands, nontaxable Indian lands, and Federal reservations other than the forest reservations, where such land is more than 5 percent of the total area of the State. There are 14 of these Federal-land States, all of which are situated west of the Mississippi River. The percentage of such lands in the several States varies considerably, and reaches a maximum of approximately 73 percent in Nevada.

The construction of highways across these relatively large areas that do not contribute to State revenues imposes a serious burden on State highway funds.

The Federal-land highways differ from the Forest highways and the Federal-aid highways in that there is no Federal-land highway system. Federal-land funds may be expended on roads which are on the Federal-aid system or on main roads not on the Federal-aid system. Contributions from the States are not required to be used in conjunction with Federal-land funds, but cooperative funds from the States may be used. Federal-land funds are sometimes expended under the supervision of State highway departments, following Federal-aid procedure, and sometimes under the direct supervision of the Bureau.

Special authorizations for the construction of roads in public lands have been made by seven congressional acts, passed up to the end of the fiscal year 1938. These authorizations, totaling $20,000,000, have made funds available for each fiscal year from 1931 through 1939, excepting 1932 and 1937. In addition $1,000,000 has been authorized for the fiscal year 1940, and $2,000,000 for the fiscal year 1941.

Federal-land projects, in large part, involve the grading and draining of new roads and the reconstruction of old roads to greater widths and to higher standards of grade and alinement. Most of these roads are subsequently improved by the addition of gravel and bituminous surfacing, in the effort to spread the relatively small funds over a considerable mileage of road. Very little mileage of the higher types of surface such as bituminous concrete and portland-cement concrete has been constructed.

During the fiscal year 116 miles of initial improvement and 146 miles of further improvement of roads previously improved were completed. The total improved mileage now existing is 1,458 miles. Tables 17, 18, 19, and 20 show details concerning the work completed during the year and the status at the end of the year.

Early in the fiscal year the bridge across the Colorado River near Parker, Ariz., was completed and opened to traffic. This bridge, with its approaches, is approximately a half mile in length.

Notable from the standpoint of continuous Federal-land construction during the fiscal year 1938 are: the Flagstaff-Fredonia highway, in Arizona, and the Ely-Tonopah highway, in Nevada.

TABLE 17.—*Public-lands funds allotted to projects completed during the fiscal year 1938*

State	Public-lands funds	Estimated total cost	Miles	State	Public-lands funds	Estimated total cost	Miles
Arizona	$127,476	$129,079	39.0	Oklahoma	$23,162	$23,162	0.1
California	277,232	387,742	20.0	Oregon	168,722	187,443	16.4
Idaho	159,656	163,004	22.6	South Dakota	75,924	76,217	8.1
Nevada	718,375	744,926	106.0	Utah	180,606	180,815	17.1
New Mexico	265,575	266,631	10.4				
North Dakota	31,619	31,619	22.8	Total	2,028,347	2,190,638	262.5

TABLE 18.—*Public-lands funds allotted to projects under contract and under construction, June 30, 1938*

State	Public-lands funds	Estimated total cost	Miles	State	Public-lands funds	Estimated total cost	Miles
Arizona	$190,843	$190,843	34.1	South Dakota	$3,144	$3,144	0.3
Montana	159,129	164,891	14.0	Utah	25,260	25,260	9.4
Nevada	374,511	374,511	54.1	Wyoming	142,390	142,390	23.1
New Mexico	107,744	107,744	13.0				
Oklahoma	28,935	37,708	.1	Total	1,031,956	1,046,491	148.1

TABLE 19.—*Public-lands funds allotted to projects approved but not under contract and balance available for programmed projects, June 30, 1938*

State	Public-lands funds	Estimated total cost	Miles	Balance available for new projects	State	Public-lands funds	Estimated total cost	Miles	Balance available for new projects
Arizona	$123,920	$123,920	13.8	$400,614	Oklahoma				$28,777
California	18,469	18,469	7.7	464,183	Oregon	$86,406	$86,406	7.1	80,990
Colorado	88,688	106,870	9.5	88,629	South Dakota				108,651
Idaho				137,534	Utah				308,176
Montana				136,937	Washington	38,349	40,889	2.5	38,507
Nevada	174,886	174,886	25.0	209,305	Wyoming				241,131
New Mexico				215,856					
North Dakota				102,026	Total	530,718	551,440	65.6	2,561,316

TABLE 20.—*Mileage of Federal-lands roads, by types of construction, completed as of June 30, 1938*

State	Graded and drained	Gravel		Macadam, treated	Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Bridges	Total
		Untreated	Treated							
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Arizona	12.4		32.1		80.8				0.5	125.8
California	.3	13.8	19.7		60.2				.3	94.3
Colorado		14.9			7.9				.1	22.9
Idaho	9.2	46.8			31.5					87.5
Montana	19.1	18.2			18.2				.2	55.7
Nevada		20.8			454.4				.1	475.3
New Mexico		18.3	10.8		28.8			6.0	.3	64.2
North Dakota	9.5	16.1								25.6
Oklahoma					5.6		1.8	2.5	.1	10.0
Oregon	3.5	130.6	5.8	4.0					.1	144.0
South Dakota	15.7	2.8	1.2							19.7
Utah		44.4			129.7		6.8		.1	181.0
Washington	.4	14.3				2.6		3.7		21.0
Wyoming	8.8		15.6		106.7				.3	131.4
Total	78.9	341.0	85.2	4.0	923.8	2.6	8.6	12.2	2.1	1,458.4

The Flagstaff-Fredonia highway is 73 miles in length, and is a part of U. S. Route 89, a heavily traveled north-south highway. A bituminous surfacing was placed on this route for a distance of 46 miles. At the close of the fiscal year, 26 miles of the route were being improved with bituminous surfacing.

The Ely-Tonopah highway, in Nevada, a Federal-land route 102 miles in length, is part of U. S. Route 6, which carries traffic directly across the State. Three Federal-land projects on this route were completed. A gravel surfacing was converted to bituminous surfacing for a distance of 37 miles, and 9 miles were graded and gravel-surfacing placed preparatory to constructing a bituminous surface.

RESTORATION OF FLOOD-DAMAGED ROADS

Funds for reconstruction of flood-damaged roads and bridges in 11 States were authorized by special acts during the period 1928–31 and this work is still active in three States. All authorized funds have been absorbed in completed work in Florida, New Hampshire, South Carolina, and Vermont. All work planned in Alabama, Georgia, Louisiana, and Mississippi has been completed.

During the year 12 miles of flood-relief construction was completed. At the close of the year 32 miles was under contract; 14 miles had been approved but contracts had not been awarded, as shown in table 21; and three States had unobligated balances as follows: Kentucky, $148,195; Arkansas, $187,762; and Missouri, $1,232.

TABLE 21.—*Status of flood-relief funds provided under special flood-relief acts*

Status and State	Flood relief funds	Estimated total cost	Miles
Completed:			
Kentucky	$93,059	$213,005	12.2
Under contract:			
Arkansas	86,458	173,467	25.1
Kentucky	69,275	138,550	7.3
Total	155,733	312,017	32.4
Approved but contracts not awarded:			
Arkansas	48,086	96,173	.2
Kentucky	103,308	206,616	10.8
Missouri	7,330	14,660	3.4
Total	158,724	317,449	14.4

The Bureau has continued to supervise other flood-relief projects at the request of the Works Progress Administration. These projects are financed by the W. P. A. and the States and, in some cases, partly with Works Program funds administered by the Bureau. The work consists of the reconstruction of flood-damaged bridges and approaches, for the most part on secondary roads. In this work, which is done by contract, the Bureau cooperates closely with the State highway departments much the same as on Federal-aid construction.

During the year 28.8 miles of bridges and approaches costing $8,103,776 was completed, bringing the total of this class of work completed to date to 34.9 miles costing $9,380,072. Work under contract or approved for contract aggregated 3.3 miles estimated to cost $3,449,678, as shown in table 22.

TABLE 22.—*Status of funds allotted for reconstruction of flood-damaged bridges by the Works Progress Administration to be supervised by the Bureau of Public Roads*

Status and State	Works Progress flood reconstruction funds	Estimated total cost	Miles	Status and State	Works Progress flood reconstruction funds	Estimated total cost	Miles
Completed:				Under contract:			
Connecticut	$175,699	$324,920	0.8	Massachusetts	$1,237,808	$2,290,166	1.6
Maine	1,629,262	1,927,370	3.3	New Hampshire	123,750	165,000	.1
Massachusetts	1,254,175	1,696,730	4.7	Pennsylvania	444,603	629,500	1.3
New Hampshire	500,024	671,963	1.4	Vermont	41,689	91,012	.1
Pennsylvania	2,727,333	3,123,121	16.6				
Vermont	41,190	74,672	.5	Total	1,847,850	3,175,678	3.1
West Virginia	142,500	285,000	1.5				
				Approved but contract not awarded:			
Total	6,470,183	8,103,776	28.8	West Virginia	68,500	274,000	.2

Federal funds to aid the States in the immediate repair of highways and bridges on the Federal-aid system damaged by floods or other forces of nature have been made available by two congressional acts. The Hayden-Cartwright Act of June 18, 1934, authorized the Secretary of Agriculture to use an amount not to exceed $10,000,000, from any funds available for expenditure under the Federal Highway Act, in the repair and reconstruction of flood-damaged highways and bridges on the Federal-aid system, and authorized future appropriation of funds expended for such purposes. An additional $8,000,000 was provided by the Federal-Aid Highway Act of 1938, approved June 8, 1938. These acts make possible the immediate repair of damaged roads without waiting for specific authorization of funds. The States are required to match these funds in the same manner as regular Federal-aid funds.

Work financed by the above authorization was completed on 31.3 miles in 9 States, costing $2,079,954 and involving $972,749 of Federal funds. Work estimated to cost $2,722,998 and involving $1,396,850 of Federal funds was under contract or approved, as shown in table 23. Flood-damage funds paid to the States amounted to $1,047,513, bringing the total paid to the States under the Hayden-Cartwright Act to $2,569,876. Funds paid to States during the fiscal year were as follows:

Kansas	$165,838	Ohio	$314,659
Kentucky	38,515	Texas	90,473
Maine	3,328	Vermont	41,844
Maryland	86,789	Virginia	76,794
Nebraska	46,456		
New Hampshire	37,364	Total	1,047,513
New York	145,453		

TABLE 23.—*Status of flood-relief funds provided under section 3 of the Hayden-Cartwright Act*

Status and State	Emergency relief funds	Estimated total cost	Miles	Status and State	Emergency relief funds	Estimated total cost	Miles
Completed:				Under contract—Con.			
Kansas	$287,106	$629,339	0.5	Maryland	$124,319	$266,639	0.7
Kentucky	31,332	62,664	3.1	Ohio	509,200	1,018,400	7.4
Maryland	9,900	20,615	.1	Vermont	36,350	72,700	2.2
New Hampshire	65,294	131,078	.3				
New York	126,886	308,485	.1	Total	783,036	1,584,073	11.2
Ohio	260,001	537,188	23.9				
Texas	113,036	226,072	.2	Approved but contract not awarded:			
Vermont	59,914	125,953	2.4	California	353,413	611,004	12.9
Virginia	19,280	38,560	.7	Maryland	68,500	137,000	.1
				Missouri	5,500	14,800	.2
Total	972,749	2,079,954	31.3	Ohio	109,220	221,760	1.1
				Virginia	77,181	154,361	.2
Under contract:							
Kansas	98,996	197,992	.2	Total	613,814	1,138,925	14.5
Kentucky	14,171	28,342	.7				

Including work completed in previous years the total obligations to the end of the fiscal year amounted to $7,879,000, leaving a balance of $2,121,000 for new projects, from funds provided by the Hayden-Cartwright Act. The $8,000,000 provided by the Federal Aid Highway Act of 1938 became available at the end of the year and no part of this fund has been obligated.

WORK-RELIEF HIGHWAY PROJECTS

Work-relief highway projects, begun in the fall of 1933 to relieve distress in drouth-stricken areas, have been continued since in areas needing special relief. Road work has been carried on by an arrangement under which the Public Works Administration has granted funds to pay material and equipment costs, limited to not more than 30 percent of the total expenditure, and the labor has been supplied from relief rolls and paid first by the Federal Emergency Relief Administration and later by the Works Progress Administration.

The Bureau, cooperating with the respective State highway departments, has assumed the responsibility of supervising road work under this arrangement.

During the year 365 miles of work of this kind costing $2,300,490 was completed, bringing the total to date to 6,366 miles. At the close of the year work was under contract on 1,092 miles, estimated to cost $9,381,947, as shown in table 24.

TABLE 24.—*Status of National Recovery work-relief projects*

Status and State	Federal funds	Total cost	Miles	Status and State	Federal funds	Total cost	Miles
Completed:				Under contract:			
Kansas	$57,180	$192,237	48.5	Minnesota	$743,892	$3,725,311	28.9
Minnesota	57,474	208,103	30.6	Oklahoma	570,000	2,000,000	442.7
Texas	561,586	1,900,150	286.1	Texas	1,064,145	3,656,636	620.8
Total	676,240	2,300,490	365.2	Total	2,378,037	9,381,947	1,092.4

LOAN-AND-GRANT HIGHWAY PROJECTS

The P. W. A. has continued the policy of financing or aiding, by loans or grants or both, the construction of roads and bridges in a number of States. Projects of this kind are initiated by their sponsors with the P. W. A. and, after agreement has been reached and funds allotted, are turned over to the Bureau for detailed administration of construction. Practically all of this work is done by the contract method.

This work was begun in 1934 with funds provided by the National Industrial Recovery Act and has been continued with funds allocated under authorization of the Emergency Relief Appropriation Act of 1935. Up to the close of the year, loans and grants of $56,436,272 had been made for specific projects 9,478 miles in length and estimated to cost $126,391,251. This represents a net increase during the year of 438 miles involving $4,798,385 of loan-and-grant funds and estimated to cost $12,612,490. Table 25 shows details by States.

TABLE 25.—*Status on June 30, 1938, of loan-and-grant Public Works projects transferred by the Public Works Administration to the Bureau of Public Roads for supervision and audit*

ALLOTMENTS FROM NATIONAL INDUSTRIAL RECOVERY ACT

State	Funds allotted by Public Works Administration			Mileage, estimated cost, and funds assigned to specific projects approved under Public Works Administration allotments				
	Tentative allotment by Special Board for Public Works	Allotment by contracts executed		Miles	Estimated total cost	Funds assigned		
		Grant	Loan			Grant	Loan	Other
Alabama	$70,247.99	$20,617.28	$49,630.71	6.7	$70,247.99	$20,617.28	$49,630.71	
California	1,310,863.65	1,310,863.65		16.4	6,063,238.26	1,310,863.65		$4,752,374.61
Connecticut	1,207,595.74	1,207,595.74		68.7	4,825,941.10	1,207,595.74		3,618,345.36
Illinois	2,418,911.71	2,418,911.71		97.6	8,176,459.46	2,377,251.02		5,799,208.44
Indiana	200,662.04	200,662.04		34.5	765,293.83	200,662.04		564,631.79
Iowa	307,586.75	307,586.75		823.6	1,061,690.12	307,586.75		754,103.37
Kansas	5,119,129.85	1,524,129.85	3,595,000.00	410.0	5,686,101.24	1,524,129.85	3,595,000.00	566,971.39
Louisiana	269,258.33	88,258.33	181,000.00	47.3	300,515.08	88,258.33	181,000.00	31,256.75
Maryland	5,411,866.00	1,411,866.00	4,000,000.00	72.1	5,090,357.16	1,408,168.25	3,541,100.08	141,088.83
Massachusetts	1,702,395.00	1,702,395.00		105.1	5,449,602.94	1,616,939.64		3,832,663.30
Michigan	10,000.00	10,000.00		29.0	39,818.00	10,000.00		29,818.00
Minnesota	1,337,211.57	952,211.57	385,000.00	472.9	3,261,752.07	952,211.57	385,000.00	1,924,540.50
Mississippi	559,135.62	161,149.30	397,986.32	85.2	505,607.99	151,682.38	344,475.26	9,450.35
Missouri	1,026,000.00	1,026,000.00		50.6	3,473,587.39	1,026,000.00		2,447,587.39
Montana	1,829,000.00	579,000.00	1,250,000.00	697.8	1,955,462.56	579,000.00	1,250,000.00	126,462.56
Nebraska	11,500.00	11,500.00		59.5	40,120.22	11,500.00		28,620.22
New York	736,814.48	375,033.67	361,780.81	30.9	1,282,140.00	375,033.67	361,780.81	545,325.52
Ohio	793,179.87	139,877.63	653,302.24	27.1	995,847.75	139,877.63	653,302.24	202,667.88
South Carolina	76,082.97	21,283.31	54,799.66	28.1	76,082.97	21,283.31	54,799.66	
Texas	1,471,020.71	931,420.71	539,600.00	238.3	3,254,907.27	931,420.71	539,600.00	1,783,886.56
Washington	2,270,571.22	2,270,571.22		1,275.2	8,209,057.61	2,270,571.22		5,938,486.39
West Virginia	2,000,000.00	2,000,000.00		453.8	6,755,786.02	1,997,850.82		4,757,935.20
Wisconsin	454,300.00	142,300.00	312,000.00	86.4	526,176.96	142,300.00	312,000.00	71,876.96
Total	30,593,333.50	18,813,233.76	11,780,099.74	5,216.8	67,865,793.99	18,670,803.86	11,267,688.76	37,927,301.37

TABLE 25.—*Status on June 30, 1938, of loan-and-grant Public Works projects transferred by the Public Works Administration to the Bureau of Public Roads for supervision and audit*—Continued

ALLOTMENTS FROM EMERGENCY RELIEF APPROPRIATION ACT OF 1935

State	Funds allotted by Public Works Administration			Mileage, estimated cost, and funds assigned to specific projects approved under Public Works Administration allotments				
	Tentative allotment by Special Board for Public Works	Allotment by contracts executed		Miles	Estimated total cost	Funds assigned		
		Grant	Loan			Grant	Loan	Other
California	$57,821.22	$57,821.22		0.4	$128,841.92	$57,821.22		$71,020.70
Colorado	3,000,000.00	3,000,000.00		266.6	7,576,275.02	2,994,301.46		4,581,973.56
Florida	71,514.42	71,514.42		.6	158,920.94	71,514.42		87,406.52
Illinois	586,673.50	586,673.50		114.1	1,373,691.06	586,673.50		787,017.56
Iowa	393,632.17	393,632.17		862.1	889,873.60	387,663.76		502,209.84
Kansas	14,463.00	14,463.00		.6	33,364.45	14,463.00		18,901.45
Maryland	1,000,000.00	1,000,000.00		25.4	1,852,497.07	833,623.67		1,018,873.40
Michigan	119,435.00	119,435.00		16.5	290,092.66	119,435.00		170,657.66
Minnesota	152,389.18	152,389.18		69.2	345,350.84	152,389.18		192,961.66
Mississippi	15,325,682.77	15,325,682.77		1,396.3	34,028,646.17	15,202,441.87		18,826,204.30
Missouri	396,699.54	396,699.54		364.5	881,689.86	396,699.54		484,990.32
Nebraska	6,611.95	6,611.95		18.0	14,914.82	6,611.95		8,302.87
New Jersey	29,862.95	29,862.95		3.1	66,362.13	29,862.95		36,499.18
New York	212,872.41	212,872.41		28.7	518,538.28	212,872.41		305,665.87
Ohio	744,519.37	356,122.93	$388,396.44	229.5	805,398.87	356,122.93	$388,396.44	60,879.50
Tennessee	349,969.34	349,969.34		1.7	625,682.15	281,556.97		344,125.18
South Carolina	712,728.27	479,728.27	233,000.00	249.7	1,056,670.58	467,963.57	233,000.00	355,707.01
Texas	2,930,192.72	2,440,192.72	490,000.00	381.9	5,857,570.83	2,440,192.72	490,000.00	2,927,378.11
Utah	45,900.00	45,900.00		29.1	116,352.95	45,900.00		70,452.95
Washington	730,883.06	730,883.06		202.9	1,904,722.67	728,272.99		1,176,449.68
Total	26,881,850.87	25,770,454.43	1,111,396.44	4,260.9	58,525,456.87	25,386,383.11	1,111,396.44	32,027,677.32

NATIONAL FOREST ROAD CONSTRUCTION

The area of the national forests is extensive, covering parts of 42 States. The greater part of this area is in the Western States, where in some instances the national-forest area is a relatively large percentage of the area of the State.

Transcontinental United States routes, Federal-aid highways, and State highways are coincident with a considerable part of the forest-highway system. Of the forest-highway system, of approximately 22,000 miles, over 39 percent is on the Federal-aid system, and an additional 39 percent is on the respective State systems, and roads of lesser importance make up only about 22 percent. It is therefore necessary that the system be constructed according to standards comparable with those used on the Federal-aid and State systems.

Construction of the forest-highway system has been under way for about 20 years, starting at a time when high standards had not come into use and when funds were relatively small. Routes could be opened up through the forests only by constructing roads having narrow widths, sharp curves, and steep grades when judged according to present standards. Surfacing was largely with local materials, such as clay-bound gravel, crushed stone, or gravel; all of which resulted in considerable mileage of low-standard roads which, while adequate for the traffic when constructed, has been gradually improved to meet constantly increasing traffic demands.

Crushed stone has been generally used for surfacing in recent years and a variety of types of bituminous construction have been developed to preserve surfaces from wear and loosening under high-speed traffic. Reconstruction has been necessary at times, in the interest of safety, to straighten roads of sharp curvature and reduce excessive grades.

With the general increase in highway traffic and expansion of highway systems it has been necessary continually to add to the original system. Approximately 1,700 miles was added during the past year. This mileage is largely in the Eastern States where new forest areas have been acquired.

The Bureau has constructed a substantial mileage on the forest-highway system, which carries interstate and transcontinental traffic, a large portion of which is recreational in character. These roads furnish millions of tourists an opportunity for recreation and enjoyment in forest areas, many of which are at a high elevation and have unusual scenic beauty. Recreation in forest areas is increasing yearly and is recognized in the design and location of forest roads by providing vistas, parking areas, and convenient accommodations for observation, camping, fishing, and hunting.

Landscaping and erosion control are of particular importance by reason of character of traffic and because of the wealth of natural beauty in the forests to be preserved. Effort is made to remove all scars of construction operations by sodding, seeding, and placing checks on washes, to control drainage and to prevent erosion. Where traffic is predominantly recreational many vistas and parking areas are provided. Emphasis is placed on the exterior appearance of the bridges, attention being given to pleasing proportions and to coordination between substructure and superstructure. Bridge railings are designed to give unobstructed vision of the surrounding country.

The two principal classes of forest roads are designated forest highways and forest-development roads, respectively. The latter class, as the name implies, serve primarily the development of the forests; the former are roads of a higher order of traffic importance, generally connecting with sections of the Federal-aid or State-highway systems outside the forests, or important community-service roads. This class requires improvement to higher standard than that required on forest-development roads.

In the main, the work supervised by the Bureau is limited to the construction and maintenance of forest highways; forest-development road work is generally administered by the Forest Service. While this definition of the work of the two classes, defining the responsibility for construction, is approximately correct, the exact line of separation is drawn between what are termed major and minor projects. Work in connection with major projects is administered by the Bureau. Major projects include all projects on the forest-highway system except those that do not require the technical services of a highway-engineering organization or those having an estimated average cost of less than $2,000 per mile. Forest-development road projects of estimated average cost greater than $5,000 per mile, and those requiring the technical services of a highway-engineering organization, are also classed as major projects.

Funds for the improvement of forest roads and trails have been authorized at a rate of $10,000,000 for each of the fiscal years 1935–37 and $14,000,000 was authorized for 1938. At the beginning of the fiscal year the active program involved $9,694,602 and $18,420,772 additional was available for new work, being in part composed of funds remaining from authorizations for previous years.

The active program involving $9,694,602 included work amounting to $6,208,594 under construction, surveys costing $1,626,750, maintenance work costing $1,447,408, and $411,850 involved in miscellaneous items. Of the $18,420,772 available for new work, $6,419,902 was assigned to projects not then under contract, and $12,000,870 was available for projects to be selected. This $12,000,870 was comprised of $9,333,333 of funds authorized for the new fiscal year and a remainder of $2,667,537 from previous years. During the year $8,475,643 was assigned to major projects and $162,767 was assigned to minor projects, leaving a balance of old funds available for programming of $3,362,460.

Major work costing $8,166,648 was put under contract and completed work amounted to $7,636,503.

At the close of the year, the active program of forest road work under the supervision of the Bureau amounted to $10,224,747, of which $6,825,767 was involved in work under construction, $1,647,091 in surveys, $1,426,578 in maintenance operations, and $325,311 in miscellaneous work. The amount available for new work was $10,091,357, of which $6,728,897 had been assigned to projects not then under contract. These amounts include the $14,000,000 authorized for the fiscal year 1939.

In accordance with requirements of the governing rules and regulations, the system of forest highways has been designated by concurrent action of the several State highway departments, the Forest Service, and this Bureau, and approved by the Secretary. Also, as required by the rules and regulations, the highways constituting this system have been classified as follows:

Class 1. Forest roads forming sections of the Federal-aid highway system, either wholly within or, when so designated by the Chief of the Forest Service and the Chief of the Bureau of Public Roads, partly without and adjacent to the national forests.

Class 2. Forest roads, not of class 1, which are parts of approved State highway systems, when so designated by the Chief of the Forest Service and the Chief of the Bureau of Public Roads.

Class 3. All other forest roads of primary importance to counties or communities.

The roads which, according to these definitions, have been classified as forest highways have an aggregate length, as of June 30, 1938, of 21,969.8 miles, classified as shown in table 26.

TABLE 26.—*Classification of the mileage of the forest-highway system at end of fiscal year 1938*

Region and State	Class 1	Class 2	Class 3	Total	Region and State	Class 1	Class 2	Class 3	Total
Western:	*Miles*	*Miles*	*Miles*	*Miles*	Eastern—Con.	*Miles*	*Miles*	*Miles*	*Miles*
Alaska	-------	-------	352.8	352.8	Louisiana	66.1	369.4	21.9	457.4
Arizona	345.8	268.6	445.0	1,059.4	Maine	-------	-------	11.0	11.0
California	635.6	1,291.0	501.8	2,428.4	Michigan	466.7	283.8	274.4	1,024.9
Colorado	533.0	1,163.0	94.0	1,790.0	Minnesota	179.4	217.7	207.4	604.5
Idaho	721.3	165.3	191.5	1,078.1	Mississippi	204.0	264.0	71.0	539.0
Montana	666.0	304.6	231.0	1,201.6	Missouri	426.2	160.1	247.3	833.6
Nevada	104.7	282.2	31.0	417.9	Nebraska	10.4	-------	18.4	28.8
New Mexico	162.0	522.0	-------	684.0	New Hampshire	40.9	92.1	41.7	174.7
Oregon	718.5	352.5	304.4	1,375.4	North Carolina	483.6	279.0	20.5	783.1
South Dakota	227.0	-------	86.0	313.0	Oklahoma	31.5	17.0	13.5	62.0
Utah	191.4	471.4	67.2	730.0	Pennsylvania	134.0	250.9	39.0	423.9
Washington	401.8	123.1	246.8	771.7	Puerto Rico	-------	-------	21.0	21.0
Wyoming	387.3	37.0	217.7	642.0	South Carolina	196.0	128.6	23.4	348.0
Total	5,094.4	4,980.7	2,769.2	12,844.3	Tennessee	131.6	133.6	80.2	345.4
Eastern:					Texas	123.5	168.4	111.2	403.1
Alabama	4.0	-------	31.0	35.0	Vermont	32.7	43.2	58.6	134.5
Arkansas	274.6	310.3	44.6	629.5	Virginia	79.0	117.9	220.0	416.9
Florida	27.3	218.9	-------	246.2	West Virginia	131.0	168.2	66.6	365.8
Georgia	110.3	36.5	58.5	205.3	Wisconsin	85.7	177.0	206.9	469.6
Illinois	192.7	27.5	48.7	268.9	Total	3,564.0	3,596.2	1,965.3	9,125.5
Kentucky	132.8	132.1	28.5	293.4	Grand total	8,658.4	8,576.9	4,734.5	21,969.8

The work done in further improving roads previously constructed considerably exceeded the building of entirely new roads. The further improvement of roads, called stage construction, totaled 374 miles. New work on the forest-highway system totaled 129.4 miles, bringing the total mileage improved to date with Federal funds to 6,694.7. Of the new mileage, 95.9 miles was in the Western States and Alaska, and the remaining 33.5 miles was in forests of the Eastern States. Of the total mileage improved, 460.1 miles is in the west and 43.3 miles is in the east. The mileage of forest highways completed by the Bureau, both stage and new, is shown in table 27.

TABLE 27.—*Mileage of completed forest-highway projects by States, fiscal year 1938*[1]

Region and State	Initial improvement and stage construction	Initial improvement	Total to June 30, 1938	Region and State	Initial improvement and stage construction	Initial improvement	Total to June 30, 1938
Western:	*Miles*	*Miles*	*Miles*	Eastern—Continued.	*Miles*	*Miles*	*Miles*
Alaska	22.0	7.7	238.2	Georgia			21.0
Arizona	24.0	5.3	575.7	Illinois			4.7
California	44.1	18.7	781.4	Kentucky	.1	.1	.1
Colorado	40.9	4.3	536.5	Louisiana	.5	.5	.5
Idaho	64.8	4.2	692.0	Michigan	6.2	6.2	56.7
Montana	42.3	16.7	609.3	Minnesota	21.6	18.3	131.8
Nevada	18.7	2.6	176.4	Missouri			8.1
New Mexico	46.0	8.8	313.6	Nebraska	6.5		8.7
Oregon	100.2	14.9	1,021.8	New Hampshire	2.8	2.8	28.0
South Dakota	7.1		61.2	North Carolina			50.9
Utah	19.5	3.1	355.5	Oklahoma	.9	.9	16.1
Washington	15.4	7.5	333.1	Pennsylvania	1.5	1.5	10.6
Wyoming	15.1	2.1	360.3	South Carolina	.4	.4	16.0
				Tennessee			47.4
Total	460.1	95.9	6,055.0	Virginia			22.9
				West Virginia			8.7
Eastern:				Wisconsin			15.7
Alabama			5.1				
Arkansas	2.7	2.7	125.0	Total	43.3	33.5	639.7
Florida	.1	.1	61.7				
				Grand total	503.4	129.4	6,694.7

[1] Changes in the mileage of completed road, resulting from abandonments, relocations, and correction resulting from recent surveys are reflected in this table.

Tables 28 and 29, respectively, show the mileage of highways under construction and completed by the Bureau, segregated by types of construction and by States.

TABLE 28.—*Mileage of forest highways under construction as of June 30, 1938*

Region and State	Graded and drained	Water-bound macadam	Bituminous surface treatment	Low-cost bituminous mix	Bituminous macadam	Portland-cement concrete pavement	Bridges	High-way-railroad grade separations	Total
Western:	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alaska	0.8	18.0					0.2		19.0
Arizona	24.3		13.2				.1		37.6
California	50.8	8.0	16.2	4.3			.2		79.5
Colorado		33.0					(1)		33.0
Idaho	26.9	15.6					.1		42.6
Montana	10.2		5.5	.5			.1	0.1	16.4
Nevada	7.6								7.6
New Mexico		.8		12.9					13.7
Oregon	11.3		15.5			0.2	(1)		27.0
South Dakota				3.9					3.9
Utah	2.2	7.2					(1)		9.4
Washington	11.1								11.1
Wyoming		2.3		8.1					10.4
Total	145.2	84.9	50.4	29.7		.2	.7	.1	311.2

[1] Mileage less than 0.1 mile.

TABLE 28.—*Mileage of forest highways under construction as of June 30, 1938*—Continued

Region and State	Graded and drained	Water-bound macadam	Bituminous surface treatment	Low-cost bituminous mix	Bituminous macadam	Portland-cement concrete pavement	Bridges	High-way-railroad grade separations	Total
Eastern:	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Arkansas		6.6					.1		6.7
Florida							.2		.2
Georgia		7.9					(1)		7.9
Minnesota	8.3								8.3
Mississippi	(1)						.1		.1
New Hampshire			1.1						1.1
North Carolina		12.4					(1)		12.4
Texas	5.0						.1		5.1
Virginia			6.5				(1)		6.5
West Virginia	1.6								1.6
Wisconsin	6.8								6.8
Total	21.7	26.9	7.6				.5		56.7
Grand total	166.9	111.8	58.0	29.7		.2	1.2	.1	367.9

[1] Mileage less than 0.1 mile.

TABLE 29.—*Completed forest highways by States and by types to June 30, 1938*

Region and State	Graded and drained	Sand-clay	Traffic-bound surfaces of miscellaneous material	Bituminous surface treatment	Low-cost bituminous mix	Bituminous macadam	Portland-cement concrete	Bridges	Total
Western:	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alaska			235.8					2.4	238.2
Arizona	213.2		298.4	24.6	15.4	23.4		.7	575.7
California	240.8		170.4	262.3	105.4			2.5	781.4
Colorado	153.6		265.3	2.0	115.3			.3	536.5
Idaho	291.5		260.0		138.2		0.1	2.2	692.0
Montana	216.1		228.5	37.5	125.2			2.0	609.3
Nevada	46.9		51.4	16.1	62.0			(1)	176.4
New Mexico	47.9		197.0	15.3	53.2			.2	313.6
Oregon	160.8		612.7	157.3	72.3	14.6	.3	3.8	1,021.8
South Dakota			46.4		14.8				61.2
Utah	133.5		162.3		59.1			.6	355.5
Washington	86.5		239.8	4.6				2.2	333.1
Wyoming	38.6		255.4		66.0			.3	360.3
Total	1,629.4		3,023.4	519.7	826.9	38.0	.4	17.2	6,055.0
Eastern:									
Alabama			5.1						5.1
Arkansas	95.9		28.5					.6	125.0
Florida		4.3		26.6	29.8			1.0	61.7
Georgia	11.0		9.9					.1	21.0
Illinois			4.7						4.7
Kentucky								.1	.1
Louisiana			.4					.1	.5
Michigan			56.7					(1)	56.7
Minnesota	55.5		60.1		16.0			.2	131.8
Missouri			8.1					(1)	8.1
Nebraska	2.2	6.5							8.7
New Hampshire			14.8	13.1				.1	28.0
North Carolina	14.2		6.6	30.1				(1)	50.9
Oklahoma	.2		15.9					(1)	16.1
Pennsylvania			1.8			8.8			10.6
South Carolina				16.0				(1)	16.0
Tennessee			47.4						47.4
Virginia	3.5		2.3	10.6		6.5		(1)	22.9
West Virginia	6.0		2.6					.1	8.7
Wisconsin	1.5		14.2						15.7
Total	190.0	10.8	279.1	96.4	45.8	15.3		2.3	639.7
Grand total	1,819.4	10.8	3,302.5	616.1	872.7	53.3	.4	19.5	6,694.7

[1] Less than 0.1 mile.

Important through routes are being developed progressively by improvements made from year to year. Examples of recent improvements are as follows.

Montana:
- Libby-State line on U. S. 2.
- Pleasant Valley highway on U. S. 2.
- Yellowstone Trail, U. S. 10.

Oregon:
- Willamette highway on U. S. 30.
- Santiam highway on U. S. 30.
- Columbia River highway on U. S. 30.
- Fremont highway on U. S. 395.
- Pendleton-John Day highway on U. S. 395.
- John Day-Burns highway on U. S. 395.
- Cascades Lakes highway.

Washington:
- Stevens Pass highway.
- Randle-Yakima highway.

Arizona:
- Fredonia-Houserock Valley highway on U. S. 89.

California:
- Placerville-Lake Tahoe highway on U. S. 50.

Colorado:
- Loveland-Fremont Pass highway on U. S. 6.
- Rabbit Ears Pass highway on U. S. 40.
- Berthoud Pass highway on U. S. 40.

New Mexico:
- Navajo Canyon highway on U. S. 285.
- Cedro Canyon highway.
- Carrizozo-Roswell highway on U. S. 380.

South Dakota:
- Deadwood-Custer-Hot Springs highway on U. S. 85-A.

Wyoming:
- Wind River highway on U. S. 287.
- Hoback Canyon highway on U. S. 187.
- Buffalo-Tensleep highway on U. S. 16.

Idaho:
- Clark Fork highway.
- Payette highway.
- Sawtooth Park highway on U. S. 93.

ROAD CONSTRUCTION IN NATIONAL PARKS AND MONUMENTS

National parks and monuments have been established in 33 States, the largest and best known being in the Western States. These areas of exceptional natural phenomena and places of particular historic significance and scenic beauty are recreation grounds for the entire Nation. Nature and events in past history have provided places that everyone desires to see and highways are the primary requirement in making them accessible to thousands of people who must plan vacation trips of moderate cost.

The construction of roads in and approaching national parks and monuments is a responsibility of the Bureau under an inter-Bureau agreement with the National Park Service.

In addition over 900 miles of parkways have been established by Congress in the East. These parkways connect points of special interest to tourists and are located on a right-of-way sufficiently broad to give complete control of roadside development. One follows closely the crest of the Blue Ridge between the Shenandoah National Park in Virginia and the Great Smoky Mountains National Park in Tennessee and North Carolina. Another follows the old historic trail between Natchez, Miss., and Nashville, Tenn.

TABLE 30.—*Highways completed in or leading to national parks and monuments, fiscal year 1938*

Park, monument, or parkway	Initial improvement and stage construction	Initial improvement completed	Total to June 30, 1938	Park, monument, or parkway	Initial improvement and stage construction	Initial improvement completed	Total to June 30, 1938
	Miles	*Miles*	*Miles*		*Miles*	*Miles*	*Miles*
Acadia	3.2	3.2	15.3	Hawaii			35.6
Blue Ridge	74.0	74.0	124.5	Hot Springs			3.5
Bryce Canyon			21.7	Kill Devil Hill			1.6
Carlsbad Caverns			8.4	Lassen Volcanic	4.7		35.1
Chalmette			.5	Meriwether Lewis			[1] 1.8
Chickamauga-Chattanooga			17.6	Mesa Verde	31.9	11.4	32.0
Colonial			[1] 12.3	Morristown			2.6
Crater Lake			57.9	Mount Rainier	29.7	1.2	[1] 81.7
Devil's Tower			.3	National Capital Parks	.4	.4	5.7
Fort Donelson			[1] 2.7	Petersburg			7.3
Fort Matanzas	.6	.6	.6	Petrified Forest	4.8	4.8	31.1
Fort Pulaski	.3	.3	.3	Rocky Mountain	46.9		51.4
Fredericksburg - Spotsylvania	.3	.3	23.5	Scotts Bluff	1.6		1.6
General Grant	6.3	3.9	10.3	Sequoia	3.8		46.1
George Washington Birthplace			2.6	Shenandoah	18.2	18.2	89.8
Gettysburg	4.2	4.2	7.3	Shiloh			10.3
Glacier	19.9	16.4	74.4	Vicksburg	.5	.5	5.3
Grand Canyon	7.7		162.1	Wind Cave			15.9
Great Smoky Mountains	7.7	4.1	27.0	Yellowstone	43.3	1.9	289.7
Guilford Courthouse	2.6	2.6	2.6	Yosemite	17.1	5.5	104.0
				Zion			18.7
				Total	329.7	153.5	1,442.7

[1] Revised figure resulting from final survey.

Highway construction in national parks and monuments is carried on under the same general plan and according to the same standards as have been described for work in the national forests with the exception that the landscaping branch of the Park Service participates actively in locating and planning highways to fit them into and preserve the natural beauty of the parks.

At the close of the year, 1,443 miles of road had been constructed in the national parks and monuments, an increase of 153 miles during the past year. This mileage includes both approach roads and parkways. In addition, 176 miles of road previously constructed was further improved, in most instances by placing a better surface. The completed mileage is shown by parks and monuments in table 30, and by types in table 31.

TABLE 31.—*Highways completed in or leading to national parks and monuments at end of fiscal year 1938, by types*

Park, monument, or parkway	Graded and drained	Gravel	Bituminous treatment	Bituminous mixture	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Bridges	Total
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Acadia		0.2	7.1		8.0				15.3
Blue Ridge Parkway	2.5	122.0							124.5
Bryce Canyon				21.7					21.7
Carlsbad Caverns				8.4					8.4
Chalmette							0.5		.5
Chickamauga-Chattanooga				10.4			7.2		17.6
Colonial	2.7		.6				8.8	0.2	12.3
Crater Lake	4.1	18.6	1.9	26.4	6.8			.1	57.9
Devil's Tower								.3	.3
Fort Donelson				2.7					2.7
Fort Matanzas				.5				.1	.6
Fort Pulaski	.1							.2	.3
Fredericksburg-Spotsylvania			18.0	5.3		0.2			23.5
General Grant	7.9		2.4						10.3
George Washington Birthplace			2.6						2.6
Gettysburg				.8		6.5			7.3
Glacier	16.4	23.7	34.1					.2	74.4
Grand Canyon		.7		146.7	14.6			.1	162.1
Great Smoky Mountains		3.6	19.4	4.0					27.0
Guilford Court House						2.6			2.6
Hawaii			10.6	9.0	16.0				35.6
Hot Springs			3.5						3.5
Kill Devil Hill				1.6					1.6
Lassen Volcanic				35.1					35.1
Meriwether Lewis				1.8					1.8
Mesa Verde				32.0					32.0
Morristown		2.6							2.6
Mount Rainier	20.5	24.7		20.7	15.5			.3	81.7
National Capital parks	1.1		.4			4.0		.2	5.7
Petersburg	1.3		6.0						7.3
Petrified Forest			4.9	26.0				.2	31.1
Rocky Mountain			8.0	43.4					51.4
Scotts Bluff							1.6		1.6
Sequoia	6.2		14.3	25.5				.1	46.1
Shenandoah	6.4	18.1	12.5	52.8					89.8
Shiloh				3.7			6.6		10.3
Vicksburg	.2	.3					4.7	.1	5.3
Wind Cave				15.9					15.9
Yellowstone		36.6	98.2	154.2				.7	289.7
Yosemite	19.4		26.3	27.7	14.1	10.0	6.2	.3	104.0
Zion				17.6			1.0	.1	18.7
Total	88.8	251.1	270.8	693.9	75.0	23.3	36.6	3.2	1,442.7

In Glacier National Park a surfaced road has been constructed through the park and across the continental divide at Logan Pass at an elevation of 6,654 feet. In Mount Rainier National Park both the Westside and Stevens Canyon routes, which are of considerable length, are being improved by including sections in each year's program. Work is now being concentrated in Stevens Canyon. In Crater Lake National Park the last section of the loop around the lake between Government Camp and Kerr Notch is approaching completion. In Yosemite the Big Oak Flat road route, involving difficult location and construction, is approaching completion. The tunnels on this route will soon be lined and sections between these tunnels graded and surfaced. There still remains a long uncompleted gap in the Tioga Road in Yosemite. This is a superb mountain highway through some of the most rugged of the high Sierras, crossing the Sierras at Tioga Pass at an elevation of nearly 10,000 feet. Additional work on this road is planned. Roads

within Yellowstone National Park and the approach road from the east are being improved.

In the Eastern States attention is being focused on the construction of parkways. The Blue Ridge Parkway following closely the crest of the Blue Ridge Mountains for approximately 480 miles passes through Virginia and North Carolina into Tennessee and connects the Shenandoah and Great Smoky Mountains National Parks. Approximately 124 miles has been completed and 157 miles is under construction, a portion of which is surfacing of roads previously graded.

The Natchez Trace Parkway passes through historic sections of Mississippi, Alabama, and Tennessee for approximately 455 miles. No mileage is as yet completed but 36 miles is under construction.

Mileage of highways under construction is listed by location and types in table 32.

TABLE 32.—*Highways under construction in or leading to national parks and monuments at end of fiscal year 1938, by types*

Park, monument, or parkway	Graded and drained	Gravel	Bituminous treatment	Bituminous mixture	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Bridges	Total
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Acadia			3.1					0.1	3.2
Blue Ridge Parkway		51.8	56.6	49.1				.3	157.8
Boulder Dam Recreational Area				9.4					9.4
Colonial			.2				1.7		1.9
Crater Lake	4.9		24.6	12.4					41.9
Glacier			16.4						16.4
Grand Canyon			30.4	14.6					45.0
Great Smoky Mountains		3.1							3.1
Mount Rainier	4.6		13.7					(1)	18.3
Natchez Trace	36.3								36.3
National Capital parks						0.6		.1	.7
Petrified Forest			4.8						4.8
Rocky Mountain				8.1					8.1
Sequoia				12.5					12.5
Shenandoah		13.8				9.5			23.3
Vicksburg			.4				2.2		2.6
Yellowstone	10.0	.9		2.1					13.0
Yosemite	2.7	12.6							15.3
Zion-Bryce Canyon	1.9								1.9
Total	60.4	82.2	150.2	108.2		10.1	3.9	.5	415.5

[1] Less than 0.1 mile.

The mileage of approach roads completed and under construction and approved for construction is reported in table 33.

TABLE 33.—*Location and length of approach roads to national parks and monuments, June 30, 1938*

Road	Park	Designated	Under construction	Completed
		Miles	*Miles*	*Miles*
Fresno-General Grant	General Grant	3.9		3.9
Cameron-Desert View	Grand Canyon	28.1		28.1
South Approach	do	52.3		52.3
Jacobs Lake-North Rim	do	31.2	31.2	[1] 31.2
Mineral-Lassen Volcanic	Lassen Volcanic	8.8		4.7 [2] 4.1
Sequoia-General Grant	Sequoia-General Grant	13.5		13.5
Custer-Wind Cave	Wind Cave	8.6		8.6
Southwest Approach	Yellowstone	13.9		13.9
Moran-Yellowstone	do	24.0		5.8
Red Lodge-Cooke City	do	59.6		59.7
East Approach	do	23.0		13.7
Zion-Bryce Canyon	Zion-Bryce Canyon	35.0	1.9	
Total		301.9	33.1	204.2

[1] Graded as a forest-road project. Figure not included in total.
[2] Completed as a forest-road project. Figure not included in total.

INTER-AMERICAN HIGHWAY

Work on the Inter-American highway continued throughout the year, and substantial progress was made in the construction of bridges and in assisting the various countries in locating and planning links in the highway. This highway, which is to extend from Laredo, Tex., to Panama City, Panama, follows a route recommended by the Bureau in 1934, as the result of a reconnaissance survey made at the request of the Department of State and the countries concerned. Recent work has been done under an authorization of $1,000,000 made in 1934 for cooperation in the survey and construction of the highway.

Under a cooperative arrangement assistance has been given to Panama, Costa Rica, Nicaragua, Honduras, and Guatemala in the erection of bridges. The United States agreed to furnish all needed engineering supervision and products of American heavy industry such as steel, cement, and equipment necessary in the work, and to transport such articles to the construction sites. The other countries agreed to furnish local materials needed for the bridges; to furnish all labor needed for construction; to build all substructures of bridges and approaches wherever necessary; and to construct the necessary sections of road to make all bridges serviceable on or immediately following construction.

Cooperation has also included the making of additional reconnaissance surveys in Guatemala, Nicaragua, and Costa Rica, and location surveys in Panama, Nicaragua, Guatemala, and Costa Rica; additional bridge investigations and surveys in all countries mentioned except Guatemala; and the designing of a group of standard bridge plans considered most useful for the immediate future programs of the several countries. A complete list of the 39 projects included under the entire program follows:

	Total length
Bridges built under contract (9):	
Rio Chiriqui, Panama	787 feet.
Rio Choluteca, Honduras	1,088 feet.
Rio Tamazulapa, Guatemala	486 feet.
Rio Las Maderas, Nicaragua	96-foot span.
Rio Platanar, Panama	120-foot span.
Rio Grande, Nicaragua	120-foot span.
Rio Esteli, Nicaragua	96-foot span.
Rio Amatal, Guatemala	96-foot span.
Rio Tahuapa, Guatemala	30-foot span.
Bridges erected by force account (6):	
Rio Chirigagua, Panama	96-foot span.
Rio San Cristobal, Panama	100-foot span.
Rio Tiucal, Guatemala	20-foot span.
Rio Zonjon, Guatemala	8-foot span.
Rio Mongoy (1) Guatemala	12-foot span.
Rio Mongoy (2) Guatemala	31-foot 4-inch span.
Bridges surveyed and designed (5):	
Rio Tenorio, Costa Rica.	
Rio Ochomogo, Nicaragua.	
Rio Viejo, Nicaragua.	
Rio Istaca, Honduras.	
Rio La Leona, Honduras.	
Bridges investigated (4):	
Rio Mula, Panama.	
Rio Chico, Panama.	
Rio Caimito, Panama.	
Rio Agua Caliente, Honduras.	
Road surveys completed (4):	
David-Concepcion-Frontera, Panama	65 miles.
Tipitapa-Rio Las Maderas, Nicaragua	20.5 miles.
Asuncion Mita-Frontera, Guatemala	12.5 miles.
Cartago-San Marcos, Costa Rica	25 miles.
Road reconnaissance surveys completed (4):	
La Conora Mountain, Guatemala	8 miles.
Progreso Mountain, Guatemala	8 miles.
Las Maderas-Sebaco, Nicaragua	30 miles.
Naranjo-Las Canas, Costa Rica	116 miles.
Roads under construction on which assistance was given in planning (3):	
Tipitapa-Rio Las Maderas, Nicaragua	18 miles.
Asuncion Mita-Frontera, Guatemala	12.5 miles.
Cartago-San Marcos, Costa Rica	25 miles.
Standard plans designed (4):	
Three pony truss bridges.	
Three through truss bridges.	
Five cantilever I-beam bridges.	
One concrete box culvert, 10 by 10 feet.	

The Chiriqui, Choluteca, and Tamazulapa Bridges which were included in a single contract were major structures of suspension design.

All of the larger bridges are now completed except those at the Rio Chirigagua and Rio San Cristobal in Panama, which are now being erected.

Shipments from the United States to the several countries for this work have amounted to a total of 6,357 tons. The more important items were cement, fabricated bridge steel, reinforcing steel, and road and bridge equipment. Miscellaneous items included culvert pipe, corrugated sheet metal, steel piling, and a small quantity of quarry supplies.

The delivery of materials and equipment from shipside to bridge site was in every case a serious problem. Deliveries of materials for the Choluteca and Tamazulapa Bridges are typical of the difficulties encountered. All shipments to Choluteca were landed at the port of Amapala, Honduras. This port is on Tigre Island, 16 miles from the mainland port. Ships anchored in the roadstead, and as there are no wharf facilities freight was discharged into open lighters. The lighters were then towed or sailed 16 miles to the mainland port where freight was discharged, loaded into carts or trucks, and hauled approximately 25 miles to the bridge site.

Deliveries for the Tamazulapa Bridge in Guatemala were made by ocean steamer at Puerto Barrios on the Caribbean side, shipped by rail to Santa Lucia, El Salvador, there unloaded, and hauled by truck 52 miles to the bridge site.

In each country where cooperative work has been conducted, a Bureau engineer has been placed in charge as resident engineer. All other positions have been filled with local engineers, most of whom have been trained in the United States. It has been the policy to aid each country in developing its own highway engineers capable of carrying on future highway programs according to the most modern standards.

Approximately 90 percent of the $1,000,000 made available in 1934 has been expended. Slightly more than 70 percent has been expended for materials produced in this country and about 20 percent has been paid for services and personnel.

Although work has been done at many points along 1,000 miles of the route and has often been accompanied by unusual difficulties and the necessity of resorting to primitive means, the cost of engineering services and overhead expenses has been kept down to about 12 percent. Expenditures by the United States for construction have been slightly exceeded by corresponding expenditures by the cooperating countries. On work for which the United States provided $680,000 the cooperators provided $710,000.

Efforts by the United States to foster the development of the Inter-American highway have been highly successful. In every country interest in road construction has been aroused and efforts are being concentrated on the route from Panama to the United States. There has been no direct cooperation with Mexico but relations with Mexican highway officials have been amicable at all times. The section of the highway from Laredo to Mexico City was completed by the Mexican Government more than a year ago and a program is now under way to complete the road from Mexico City to Guatemala, although the original plan of the Mexican authorities was to direct the next effort to a route on the Pacific coast from Arizona to Mexico City.

In Guatemala the highway organization has been notably strengthened and reconstruction and betterments now in progress will make the road across Guatemala entirely serviceable at all seasons of the year by 1940.

Very friendly relations have been maintained with the highway authorities of El Salvador but there has been no active participation in highway work there. Encouraged by the work in neighboring countries the Government of El Salvador is carrying on a program under which the entire route across this Republic will be three-quarters completed in 1940, and probably entirely completed in 1941.

In Honduras only about 90 miles of highway are included in the inter-American route, and one-third of this is now passable at all seasons. The Government of Honduras has requested further engineering assistance, and if possible, further cooperation in improving this section.

In Nicaragua the Government has tried twice to enter into a satisfactory contract with private contractors for a considerable mileage of highway construction, but difficulties in independently financing a large program have so far prevented success in this direction. The Government is able, however, to expend from 40,000 to 60,000 cordobas ($8,000 to $12,000) a month and has requested further surveys and engineering assistance in extending the improved road in that country. At the last session of the Congress of Costa Rica, 1,050,000 colones ($187,200) was appropriated to provide for cooperative construction under the direction of Bureau engineers, and also for about 12½ miles of additional road, all on the inter-American route.

The Government of Panama has committed itself to complete approximately 65 miles of road north of David, where assistance has been given in the construction of three bridges. This work will complete the road from Panama City to the Costa Rica line. Owing to the present financial condition of Panama, construction is proceeding slowly but steadily.

The present general status of the inter-American highway from Laredo, Tex., to Panama City is given in table 34.

TABLE 34.—*Status of improvement of the inter-American highway, Laredo, Tex., to Panama, June 30, 1938* [1]

Section	Paved road	Gravel road	Graded earth road	Ungraded road or trail
	Miles	*Miles*	*Miles*	*Miles*
Nuevo Laredo-Mexico City	765			
Mexico City-Oaxaca	40			300
Oaxaca-Guatemala line				635
Mexico line-Quetzaltenango				80
Quetzaltenango-Asuncion Mita		212		
Asuncion Mita-El Salvador line			24	
Guatemala line-Santana		20	4	
Santana-San Vicente	30	49		
San Vicente-Honduras line				88
El Salvador line-San Lorenzo				37
San Lorenzo-Choluteca		23		
Choluteca-Nicaragua line				30
Honduras line-Esteli				50
Esteli-Las Maderas				60
Las Maderas-Managua		35		
Managua-Costa Rica line				100
Nicaragua line-Naranjo				163
Naranjo-Cartago	48			
Cartago-Panama line				145
Costa Rica line-David			15	44
David-Panama City	200	108		
Total	1,083	447	43	1,732

[1] Mileage figures based on proposed new location in Mexico and Nicaragua.

If the programs in Mexico, Guatemala, and El Salvador are carried out as now projected, an all-weather road should be completed as far south as Choluteca, Honduras, by the end of 1941.

TRANSPORTATION, ECONOMIC, AND STATISTICAL INVESTIGATIONS

HIGHWAY-PLANNING SURVEYS

At the beginning of the year, 43 States had undertaken State-wide highway planning surveys in cooperation with the Bureau under authority contained in the Hayden-Cartwright Act of 1934 and subsequent legislation which authorized the Secretary of Agriculture to approve allotments of not to exceed 1½ percent of the amount of Federal highway funds apportioned for any year, for surveys, plans, and engineering and economic investigations of projects for future construction. Since then, three additional States, New Jersey, Mississippi, and Connecticut, have undertaken the work, bringing the total to 46.

Many States which undertook the surveys when they were first proposed by the Bureau have progressed to the point of interpreting the data for a series of reports to their citizens on the status of the highway plant, generally following an outline suggested by the Bureau. The planning surveys are demonstrating their value more convincingly as analysis of the data progresses and the results are used in supplying facts and figures to other branches of the highway departments and to interested agencies. In this way the surveys have served as an essential aid in the general administration and operation of government. Upon request copies of the county base maps prepared in connection with the surveys have been furnished to the National Park Service, the Agricultural Adjustment Administration, the Soil Conservation Service, and other agencies. Copies will also be furnished to the Census Bureau for use in taking the 1940 census. In a number of instances, traffic information has been furnished to the Forest Service for use in planning roads under their jurisdiction.

Field inventories of the rural road system have been completed in 38 States with 2,519,000 miles of road. In eight other States, with an estimated road mileage of 406,583, the mileage inventoried to June 30 was 170,429. Preparation of base maps showing all rural roads and other essential data, is progressing and most States expect to complete the majority of their maps by the middle of the 1939 fiscal year. Alabama, Arizona, Arkansas, Idaho, Illinois, Kansas, Montana, Nebraska, North Dakota, Oregon, and Wyoming have completed base map tracings. Approximately 4,080 base maps will be required for the 3,005 counties of the States now conducting planning surveys. Already 1,625 maps have been forwarded to Washington for examination. Base maps, in general, have been constructed on well established land coordinates in close cooperation with the General Land Office, the Geological Survey, and the Coast and Geodetic Survey. Nineteen States have reported the use of aerial photographs in making or checking county base maps, and Virginia in particular will have the advantage of aerial photographs of its entire area.

The surveys include the collection of data on sharp curves, steep grades, lack of superelevation, and limited sight distance on the primary highways, and a record is made of the location and nature of critical restrictions. These data are assembled under two general classes: (1) Nonmountainous roads having sight distances of less than 1,000 feet, curvature exceeding 6°, and grades exceeding 5 percent; and (2) mountainous roads having sight distances less than 650 feet, curvature exceeding 14°, and grades exceeding 8 percent. These data will reveal critical sections of the highway system requiring early attention and, when correlated with traffic density and accident records, will provide the basis for highway programs in which priority will be given to those improvements most urgently needed.

In cooperation with the Association of American Railroads, pertinent facts relating to rural and urban grade crossings are being obtained which will be combined with a field inventory of the crossings and traffic data to arrive at programs of abandonment, protection, and elimination by separation of grades, giving priority to the most dangerous crossings. Most of the data to be supplied by the railroads have been received and await the completion of the urban-crossing inventory.

Field work on traffic surveys has been completed by the majority of the States. At 3,323 weighing stations, the weights of trucks, commodities carried, as well as other data, were recorded for thousands of trucks, tractor-truck semitrailers, and trucks with full trailers. Information on the tonnage moved over the highways has been obtained from stations where portable weighing devices were used, while more detailed and precise data were obtained at pit-scale stations to determine loading practices. Such data have important bearing on regulation and taxation. Information regarding the weights and dimensions of busses and number of passengers carried was also obtained at these stations. Traffic-flow maps for the primary road system have been prepared by nine States.

Working continually are 353 automatic traffic-recording machines, recording the hourly passage of vehicles. The design of these units was originally conceived by the Bureau and later perfected by commercial organizations. Installed at strategically located points, these machines provide a long-period record of traffic volume. Completeness of the records permits the determination of characteristic traffic patterns and factors with which to expand short-period counts to annual averages and to show minimum, average, and maximum traffic volumes.

Summaries of road-life data, extracted from the records of State highway departments are being prepared in all States making the planning surveys. Life tables are being prepared and the probable average life determined for each surface type as well as construction costs, maintenance costs, and probable salvage value. From a careful interpretation of these data, more dependable estimates may be made of the public investment in highways, cost of ownership, and probable annual cost of present and future improvements.

The financial surveys involve studies of highway income, expenditure, and debt of the State and of all the subdivisions within the State. They will indicate where and how the money is now being spent and for what purpose. Motor-vehicle allocation studies, based on an analysis of questionnaires received from motor-vehicle owners, will show the location and occupation of persons paying motor taxes and the share paid by residents of cities, towns, and rural areas. The road-use surveys will show the benefits derived from roads, and the extent of use by the various classes of residents.

Information regarding land uses, present and potential, which will have a direct bearing on rural road improvements is to be obtained in an extensive survey

contemplated by the Bureau of Agricultural Economics in cooperation with a number of other agencies of the Department, including this Bureau. Plans for the survey include a classification of land according to its usefulness for agricultural purposes. This information will be used in preparing county maps which will show submarginal areas and the various degrees of usefulness of areas suitable for agriculture.

SAFETY RESEARCH

The results of the safety studies made during the previous year in cooperation with the Highway Research Board of the National Research Council were embodied in a detailed report and published in six parts as House Document No. 462, Seventy-fifth Congress, third session. The six parts are entitled:

Part 1. Nonuniformity of State Motor-Vehicle Traffic Laws.
Part 2. Skilled Investigation at the Scene of the Accident Needed to Develop Causes.
Part 3. Inadequacy of State Motor-Vehicle Accident Reporting.
Part 4. Official Inspection of Vehicles.
Part 5. Case Histories of Fatal Highway Accidents.
Part 6. The Accident-Prone Driver.

A summary report on these researches was also prepared and published as a bulletin of the Bureau, Highway Accidents, Their Causes and Recommendations for Their Prevention.

By cooperative agreement with the Highway Research Board, certain research projects in highway safety that could not be completed for inclusion in the report to Congress were continued, particularly an investigation of the validity and utility of driver test clinics in identifying and re-educating the accident-prone driver.

MAINTENANCE-COST STUDIES

Agreements with the State Highway Departments of Connecticut, New Hampshire, and Rhode Island for a study of highway-maintenance costs in relation to traffic volume were renewed for the fourth year. Traffic records for the third consecutive year were obtained for 31 sections of highway in Connecticut, 52 sections in New Hampshire, and 102 sections in Rhode Island. The States were furnished copies of the records with the average 24-hour traffic density on each section. A detailed report on each section was completed. Detailed maintenance costs on each of the sections are being kept by the States and supplied to the Bureau.

The object of this study is to determine the maintenance costs for different types of road surface in relation to the traffic carried. Due to nonperiodic or infrequent costs of maintenance, no determinations can be made until the records have been kept for a period of at least 5 years.

HIGHWAY-CAPACITY AND VEHICLE-PERFORMANCE STUDIES

Traffic-capacity studies in cooperation with the Illinois Highway Planning Survey were continued. Analysis of the field data was made in Washington and in Chicago. Attention was directed to the design of equipment to reduce the cost and labor of collecting data, and for use in broadening the field of study.

Under cooperative agreements with the Quartermaster Corps of the United States Army and the National Bureau of Standards, and with the assistance of a number of truck manufacturers, an exhaustive study of the performance of new trucks on highway grades was begun. Actual performance of a number of trucks will be determined on a series of grades, and laboratory tests will be conducted on the same vehicles to determine their engine efficiency.

Methods were developed and apparatus was designed and assembled for studying in detail the movements of vehicles over long sections of highway. The normal driving practices under various conditions of traffic and of physical alinement, as well as the distances required for passing under various conditions, will be determined with this apparatus.

Methods were developed, equipment was designed and assembled, and preliminary studies were conducted to determine the lateral placement of vehicles on the highway. This apparatus is to be used in conjunction with apparatus being developed that will automatically indicate the speed of vehicles. This equipment is to be used in a variety of localized studies of driving practices and how they are affected by various conditions of traffic volume and speed, width, surface, and alinement of the highway, and type and condition of the shoulders.

NATIONAL CONFERENCE ON STREET AND HIGHWAY SAFETY

The Bureau continued to cooperate with the executive committee of the National Conference on Street and Highway Safety in the promotion of uniform traffic regulation. Copies of the Uniform Vehicle Code and other literature prepared by the Conference were widely distributed. A revised edition of the pamphlet Guides to Traffic Safety, originally prepared by the executive committee of the Conference in 1934, was published by the Bureau. The Conference reprinted a second large edition of the Manual on Uniform Traffic Control Devices for Streets and Highways compiled in 1935 by a joint committee representing the conference and the American Association of State Highway Officials. At the close of the year, plans were being made for meetings of the committee on uniform traffic laws and ordinances of the Conference to revise the Uniform Vehicle Code and the Model Traffic Ordinance. The joint committee on uniform traffic control devices was also making preparations for revision of the Manual on Uniform Traffic Control Devices for Streets and Highways.

AMERICAN ASSOCIATION OF MOTOR VEHICLE ADMINISTRATORS

Active cooperation was continued with the Association in its program of education and research to advance uniformity in State motor-vehicle laws, reciprocity between States, and in measures aimed at greater highway safety. During most of the year a member of the Bureau staff served as executive secretary of the Association. Under a subsequent arrangement, the Bureau is cooperating with the Automotive Safety Foundation and the National Conservation Bureau in establishing in Washington an administrative office for the Association, with an executive director.

ESTIMATING HIGHWAY-TRAFFIC VOLUME

Further research on the problem of estimating the volume of highway traffic for long periods by extending counts of limited duration made according to fixed schedules has been conducted to determine the most efficient procedure. It is desired to obtain estimates that are closely representative of actual traffic with the minimum number and duration of counts. Precision is affected not only by the number and length of the counting periods, but also by the parts of the day, the days of the week, and the months of the year during which the observations are made. Records from different parts of the country have been studied to determine periods of least dispersion and greatest reliability for sampling. A research report was presented at the annual meeting of the Highway Research Board in 1937.

RAILROAD-ABANDONMENT STUDIES

Abstracts were completed of the records from 1920 to May 31, 1937, of proceedings before the Interstate Commerce Commission for certificates of convenience and necessity permitting the abandonment of railroad lines.

The abstracted data were assembled in tabular form for each abandoned section of railroad to show the carrier, mileage of line, average investment per mile, population density, passenger and freight operating statistics for the last 5 years of operation, purposes for which the railroad was constructed, and reasons for the abandonment of operation. The data were summarized by States.

The proceedings of the Interstate Commerce Commission were also reviewed to determine the portions of the railroads abandoned that were later returned to operation.

The continuing purpose of these investigations is to ascertain what additional burden must be assumed by the highways as the abandonment of railroad lines progresses, especially the abandonment of unprofitable branches originally constructed as feeders to the main lines of railroads. It is desired to keep constantly informed as to the changing interrelationship between highway and railway patterns in each State.

By the orderly examination of causes and conditions surrounding former abandonments, it is hoped to arrive at ways of foreseeing future abandonments and the probable eventual relation between rail and highway transport which should so develop as to produce the largest public benefit from each form of transportation.

PHYSICAL RESEARCH

For a number of years the Bureau has been planning permanent laboratories for its research work at a location where there would be space for outdoor experiments. In previous years funds had been authorized for such an undertaking,

land had been acquired on the Mount Vernon Memorial Highway near Washington and plans had been prepared for laboratories and offices to house the Division of Tests.

Early in the fiscal year a contract for construction was awarded, work was begun soon thereafter, and is now nearing completion. It is expected that during the next fiscal year all the activities of the Bureau at the Arlington Experiment Farm of the Department will be transferred to the new research station.

SUBSURFACE EXPLORATION

The application of electrical resistivity and seismic methods in determining the distance from the ground surface to rock has been continued. Both types of apparatus have now been brought to a satisfactory state of development. Instruments of the types developed by the Bureau are now available commercially.

A complete set of seismic equipment has been purchased for use in the Bureau's work in the Western States and engineers are being given field instruction in its use.

During August and September 1938, at the request of the Corps of Engineers of the United States Army, demonstrations were made of the application of the seismic method of subsurface exploration to problems that arose in flood-control work in New York and New England. The tests indicated that information valuable in such work can be obtained with this equipment at relatively low cost.

In May 1938, at the request of the New Hampshire State Highway Department, demonstrations of both methods of exploration were conducted on a variety of highway projects in that State. By invitation the tests were observed by engineers from neighboring States, the Corps of Engineers and other interested agencies. The electrical-resistivity method was found to be unsatisfactory in the soils encountered, but the seismic method proved its value in detecting and locating the position of solid ledge rock. In the salt-water marshes the seismic method could not be used to determine the depth to solid sand layers where the overlying muck was in a fluid state.

An educational film strip, with text describing the principles and application of the two methods of exploration, has been prepared and copies are being distributed to State highway departments and universities.

MOTOR-VEHICLE IMPACT INVESTIGATIONS

The study of the elastic properties of concrete when acted upon by comparable static and impact forces, as mentioned in the last annual report, has been continued. This fundamental research is expected to furnish a connecting link between the considerable volume of data already obtained on (1) the effects of static loads on concrete pavement slabs, and (2) the magnitude and frequency of the impact forces developed on the highway by motor vehicles. This work is an important part of a broad research to rationalize the structural design of pavements.

A report was published describing the apparatus and method of test. It is anticipated that a progress report describing the results of the tests to date may be published during the coming year.

MEASUREMENT OF ROAD-SURFACE ROUGHNESS

Smoothness of road surface is necessary for comfort in travel and is a matter of concern to every highway engineer. There has been no reliable means for measuring degrees of road roughness. The Bureau has attempted to develop suitable apparatus, and definite progress has been made. A special standardizable one-wheel trailer has been built on which is mounted a device for integrating the successive vehicle spring deflections as the vehicle is towed along the road. This apparatus is ready for preliminary trials.

THE STRUCTURAL DESIGN OF CONCRETE PAVEMENTS

Work in this important field of investigation has been continued. Four reports on the recent researches at the Arlington Experiment Farm have already been published and a fifth report is in the course of preparation. The results presented in the fourth report of the series dealing with the design of joints in concrete pavements resulted in the submission to the Bureau for approval of many new designs, among which were a number of the dowel-plate type. In order to determine the merits of the designs, certain additional or supplementary tests were found to be necessary and are being made.

Final arrangements were made with the Indiana State Highway Commission for the construction of specially reinforced pavement sections on one of their current Federal-aid projects. This work will be done during the coming year. The purpose of this research is to determine the extent to which longitudinal steel reinforcement can be used economically to increase the spacing between transverse joints.

A survey of a considerable number of the older concrete pavements in Michigan was made in June 1938 in cooperation with the Michigan State Highway Department. These pavements were designed without provision for load transfer at the joints. The purpose of the survey was to determine the effect on pavement condition of the absence of provision for load transfer. The pavements studied were, in general, about 10 years old and were on the more heavily traveled routes.

EROSION TEST FOR CULVERT PIPE

Study of the erosion test for quality of bituminous coatings on corrugated-metal culvert pipe has been continued. In recent experiments, an abrasive charge of portland-cement mortar cubes has been used. A progress report covering these tests has been prepared.

The work that has been done indicates that the substitution of mortar cubes for the fragments of brick that are now specified improves the test in that more consistent results are obtained on duplicate samples. However, the test method appears to be deficient in certain respects and consideration is now being given to the possibilities of some other method.

THE STRUCTURAL DESIGN OF NONRIGID PAVEMENTS

Study of this important problem has been under way for some time and during the year a report reviewing past researches and summarizing present knowledge was published. Considerable study has been given to the development of needed instruments, particularly the development of devices for measuring pressures as distributed through nonrigid road surfaces.

INVESTIGATION OF SUPPORTING STRENGTH OF FLEXIBLE CULVERT PIPE IN EARTH EMBANKMENTS

The study of experimental installations of flexible culvert pipe buried in earth fills was continued and a progress report was published. This report presents a theoretical analysis of the problem, applicable to the design of flexible pipe culverts, and a comparison of the results of this analysis with the phenomena observed in the experimental installations. This investigation is to be extended to include observations in the field of the performance of a considerable number of culvert structures to determine, over a wide range of conditions, the value of certain constants that are required in theoretical computations of loads and supporting strength. These field observations will begin during construction of the culverts and will continue for some time thereafter. This is a cooperative study by the Bureau and the Engineering Experiment Station of Iowa State College.

INVESTIGATION OF BRIDGE FLOORS

The cooperative investigation of the action under load of concrete floor slabs of bridges, begun at the University of Illinois in 1936, was continued. This involves theoretical mathematical analyses of various types of floors and the verification of these analyses by observation of experimental floor slabs constructed in the laboratory. Two valuable reports on this work were published as bulletins of the University. One describes a distribution procedure for the analysis of slabs continuous over flexible supports and the other gives solutions for a number of special cases. This work is conducted cooperatively by the Bureau, the Illinois Division of Highways, and the University of Illinois.

FATIGUE STRENGTH OF WELDED JOINTS

The use of arc welding in fabricating steel highway bridges has been hampered by a lack of knowledge of the strength of welded connections when subjected to repeated applications of stress. The fatigue strength of steel, or its resistance to a great number of load applications, is much less than its strength as measured by one load or a few loads, and therefore it is a characteristic of major importance in bridge design. Arrangements have been made for a comprehensive laboratory

study of the fatigue strength of various types of welded joints. In this investigation the Bureau is cooperating with the University of Illinois and the welding research committee of The Engineering Foundation. The tests are to be made at the University.

CEMENTS, AGGREGATES, AND CONCRETE

A laboratory study to determine the effect of using a blend of natural and portland cements on the strength and durability of concrete was completed and a report is being prepared for publication. The report will present the conclusion that, although the crushing and flexural strength of pavement concrete may be slightly reduced by substituting one of the natural cements studied for 14 or 28 percent of portland cement, the resistance of the surface of the pavement to alternate freezing and thawing will be materially increased. Similar tests made with another brand of natural cement of approximately the same chemical composition did not show the same improvement, indicating that the beneficial effect of the natural cement may be influenced by the method of manufacture. Further information along this line will be obtained during the coming year through the inspection of experimental pavements in New York State in which both brands of natural cement have been used.

The extended series of tests to determine the relative efficiencies of different methods of curing concrete were completed and a report is being prepared for publication. Preliminary indications pointing to the importance of applying moisture to the surface of concrete slabs during the early curing period rather than merely sealing the existing moisture within the slab were confirmed.

The Bureau was requested by a committee of the American Society for Testing Materials to cooperate in a series of laboratory tests as part of a study of methods of measuring the soundness of portland cement by the use of a high-pressure steam (autoclave) test. Thirty-five portland cements were tested and the results reported to the committee. In addition, numerous other special tests of cement, all designed to measure properties not revealed by the present standard tests, were investigated. These included methods of determining the bleeding characteristics of cements and various tests to determine the efficiency of the operation of burning the mixture of raw materials in the manufacture of portland cement.

A study of the causes of deterioration of concrete pavements in certain of the Southeastern States indicates the probability that variations in quality of cement not covered by the present specifications may account for at least some of the trouble. In view of this fact, the laboratory studies of cement described above are considered highly important and will be continued.

Work on aggregates has been confined largely to continuation of studies of the Los Angeles abrasion test. Additional data correlating the results of the test with service behavior have been obtained and a report was published. A paper discussing the relation between the results of the Los Angeles test and a special roller test designed to simulate the action of a road roller is in course of preparation.

BITUMINOUS ROAD MATERIALS

Research to determine the significant properties of bituminous materials and aggregates and to correlate those properties with service behavior was continued along the lines followed in previous years. Laboratory tests, performed by commonly accepted methods, were made on materials for (1) compliance with given specifications on routine construction, (2) standardization and perfection of procedure, and (3) determining the suitability of new materials and combinations of materials. Additional tests were also performed on materials and mixtures by methods more recently developed to provide more information on quality and serviceability and to determine the effectiveness of the methods used.

Correlation between laboratory test results and field behavior was attempted by observation of bituminous roads of known characteristics. Differences in service behavior were compared with test results obtained in the laboratory.

Studies of general or special significance, designed to verify accepted theories or to develop additional information on bituminous materials and mixtures, were initiated or continued by the Bureau alone or in cooperation with State highway departments and committees of technical organizations.

Laboratory investigations of the physical and chemical properties of asphaltic materials, tars, and emulsions, and the behavior of surfacing materials containing them, were continued. Changes in refinery procedure and the development of new paving mixtures make a continuation of these studies necessary.

The laboratory examination of asphalt cements in general use throughout the United States was completed, and the data, which are being embodied in a report, will be of considerable assistance in evaluating such changes in specification requirements as are often proposed and in suggesting changes that may be of value in the control of this class of material. This work is to be supplemented by mechanical tests on sand mixtures containing these materials in order to determine more definitely their probable service behavior.

In cooperation with the Minnesota State Highway Department and the University of Minnesota, the laboratory study of asphalts in use in that area was continued. The effect of various aging processes and the value of the various tests in showing the changes that occur in the asphaltic materials and mixtures were studied.

The field and laboratory investigation of sheet-asphalt construction and its service behavior on two projects in the District of Columbia were continued. The changes that occurred during the preparation of the mixtures have been determined, and changes that occur during service will be determined from time to time.

In cooperation with the Ohio Highway Department, a study of the character of the asphalts in old pavements was completed and a report on this investigation is being prepared.

The determination of the absolute viscosity of all grades of bituminous materials was continued. Determinations of the absolute viscosity of a large number of asphalts of 50–60 and 85–100 penetration was completed and a report will be prepared on this work.

A number of bituminous materials and bituminous mixes were subjected to accelerated weathering in a special apparatus.

A study is being made of the microscopic film test to determine its suitability as a specification requirement.

The study to determine the resistance in different bituminous mixtures to stripping of the bituminous films from the particles of aggregate due to the action of moisture is being continued.

The bituminous and nonbituminous joint-filling materials installed on a section of the Mount Vernon Memorial Highway are still under observation. Several new materials, untried but appearing to have promise, were installed.

The experimental roads built in Alabama, North Carolina, Tennessee, and South Carolina, to study the use of cotton fabric in bituminous construction, are under observation and reports of construction, maintenance, and service behavior of similar roads built by a number of States with cotton fabric furnished to them under the cotton diversion program are being received from the States participating.

SUBGRADE INVESTIGATIONS

The Bureau's investigations of subgrade soils and their utilization in highway construction are of a continuous nature and include a number of separate activities. Some of these are closely related, while others are related only in that they have the common objective of improving highway construction through a greater knowledge of the performance of soil materials when used for a variety of purposes.

Application of soil mechanics in the design of foundations for buildings, earth dams, and earth embankments for highways, is receiving much attention. Theoretical analyses of the various problems are being made and much work is being done in the development and interpretation of appropriate laboratory tests. This work has been and will continue to be supplemented by field observations as the opportunities arise. Studies are being made with two devices for making direct tests of shear resistance and with the stabilometer which establishes the relation between the horizontal pressure developed by a soil sample and the vertical pressure to which it is subjected. The data obtained in these tests disclose wide differences in the stress-deformation relations of different cohesive soils. A study is being made of the practical application of shear-test data in the design of structures. A report on the principles of soils mechanics involved in fill construction was published.

Investigations of soil stabilization as applied to fill construction and the construction of road bases continues to be a major activity. Progress was made in the study of the relation between moisture content, density, and stability of soils and a further study is being made of the volume changes of soils that have been compacted under a variety of conditions. Arrangements were made to study fill consolidation and the economic value of the control of moisture and

density in fill construction on three highway-construction jobs. The fills on these jobs will be consolidated by a number of methods, costs will be obtained, and settlements will be observed over a period of years. The projects are located in Indiana, Ohio, and South Carolina, and the experimental work is to be done in cooperation with the respective State highway departments.

Several series of tests of stabilized bases were made on the small circular tracks at the Arlington Experiment Farm. As a result, a report on the influence of grading and plasticity on the performance of sand-clay and sand-clay-gravel bases was prepared for publication. A similar report on the effect of chemicals on the properties of base-course materials and on the use of chert gravels, quarry screenings, etc., is in preparation. The data obtained in these studies have been utilized in the preparation of specifications for materials to be used in base-course construction.

Preliminary to the construction of an experimental road, a study of the use of portland cement as a stabilizing agent in base construction was made on one of the small circular tracks. The experiment in the stabilization of soil with cement will involve the construction of a number of different sections of road in which the proportion of cement and the thickness of the stabilized base will be varied. The experimental road is located in South Carolina and the Bureau is cooperating with the State Highway Department in its construction.

Different agencies use different tests to measure the desired characteristics of stabilized soils and to determine the optimum content of admixtures used for stabilization. The Bureau has started a comprehensive laboratory investigation to study the fundamentals of soil stabilization with admixtures such as bituminous materials and portland cement and to develop and standardize satisfactory test procedures.

For some years the Bureau has furnished to interested laboratories standard check samples of soils for use in the instruction of laboratory personnel and to improve and standardize the technique of testing. The demand for this service continues. An analysis of the test results obtained with these samples by the various laboratories provides information relative to errors in testing procedure and as to the degree of uniformity of results that may be expected when the tests are made by different laboratories in strict accordance with the standard methods. The standard methods of test are being studied constantly in order to improve and simplify them.

The Bureau is cooperating with the Forest Service in a laboratory investigation of the effect of various colloidal materials on the permeability of sandy soils. The purpose is to determine the best method of treating sandy soils used in the construction of earth dams.

Two special 2-week courses of instruction in soil surveying and sampling, soil testing, and soil mechanics were held in Washington. The attendance at both courses was large and was comprised of representatives of Federal bureaus, State highway departments, universities, foreign governments, and commercial organizations.

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REPORT OF THE CHIEF OF THE SOIL CONSERVATION SERVICE, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
SOIL CONSERVATION SERVICE,
Washington, D. C., October 15, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I present herewith the report of the Soil Conservation Service for the fiscal year ended June 30, 1938.

Sincerely yours,

H. H. BENNETT, *Chief.*

CONTENTS

	Page
Introduction	1
Cooperative relations and planning	2
Cooperative planning	3
Cooperative relations in extension	3
Information	4
Operations	7
Civilian Conservation Corps operations	24
Erosion-control practices	25
Agronomy and range management	27
Engineering	29
Woodland management	31
Wildlife management	31
Conservation nurseries	33
Research	35
Experiment stations	35
Watershed and hydrologic studies	37
Research—Continued.	
Geographic and climatic studies	41
Sedimentation studies	44
Economics of soil conservation	47
Hill-culture research	48
Evaluation surveys and field tests	49
Library	49
Puerto Rico and the Virgin Islands	49
Watershed and conservation surveys	50
Conservation surveys	51
Flood-control surveys	52
Cartography	52
Administration	53
Fiscal	54
Procurement	54
Personnel and training	54

INTRODUCTION

The formation of soil conservation districts in various parts of the country gave new impetus during the year to conservation of the Nation's soil resources. A sense of community responsibility for the solution of soil-erosion and land use problems began to replace the attitude that an individual's land is an individual's problem—and his alone. Community action for land defense gained wide support.

Soil conservation districts became the vehicle of community conservation work. In 18 of the 25 States having laws authorizing the formation of districts, farmers organized 72 districts, embracing an aggregate area of more than 38,500,000 acres. By the close of the year, the Soil Conservation Service was cooperating actively with 34 of these districts. Through them, the State and Federal Governments, local communities, and the individual were linked together in a correlated drive toward common conservation objectives.

The 18 States in which soil conservation districts had been established by the end of the year were Arkansas, Colorado, Florida, Georgia, Kansas, Maryland, Michigan, Minnesota, Nebraska, Nevada, New Jersey, New Mexico, North Carolina, North Dakota, Oklahoma, South Carolina, South Dakota, and Utah. In California, Illinois, Indiana, Mississippi, Pennsylvania, Virginia, and Wisconsin, districts legislation had been enacted, but districts had not yet been formed. However, several were in the process of formation and many more were under consideration.

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In many of the 23 States without district laws, appropriate legislation was being either developed or considered. Indications point toward the enactment of districts legislation in a majority of these States during the next few years, and possibly before the close of the fiscal year 1940.

With the development of soil conservation districts and the subsequent alliance of many of them with the United States Department of Agriculture, essential adjustments were made in the basic operating policies of the Service. While 18 new demonstration projects were established during the year, 59 of the projects previously established were shifted to a maintenance status. (Including the demonstrations transferred from an active status prior to July 1, 1937, 111 of the 166 Service projects on privately owned land were on a maintenance basis at the end of the year.) Particular emphasis was placed on cooperation with districts, especially in the formulation and review of individual district programs and work plans. Procedures were developed under which the Service may provide, insofar as possible, technical aid, certain materials and equipment, and other assistance to cooperating districts. In several parts of the country, district activity moved from the planning table to the field. Surveys were started and conservation practices introduced.

The new emphasis on cooperation with districts, however, is not to be construed as an abandonment of the demonstration projects. During the year it became increasingly evident that the demonstrations are exerting a progressively greater influence for conservation. Soil- and water-conserving measures demonstrated in the areas spread faster and farther than in any previous year. Such practices as strip cropping, contour tillage, and winter cover cropping won wider acceptance. Terracing gained support in virtually every State. The natural reluctance of many farmers to make changes in their farming operations disappeared as the demonstrations showed the merit of conservation methods for the second, third, fourth, or fifth consecutive year, depending on the life of the project. Further, the demonstrations were directly responsible for a substantial part of the year's progress in district activity. By stimulating general interest in soil conservation and providing tangible evidence of the benefits of conservation farming, they prompted farmers to seek a solution to their individual and collective erosion problems through effective community organization.

The total area covered by the demonstration operations was extended to approximately 11½ million acres of privately owned land. More than 61,000 farmers and ranchers were cooperating in this phase of the Service program and they had agreed to divert 867,866 of the 5,277,092 acres originally in cultivation to uses considerably less conducive to erosion. At the close of the year, 490,070 acres had already been taken out of cultivation and converted to permanent hay, range or pasture, woods, orchards, vineyards, wildlife habitats, and other conservative uses.

At the same time, other phases of the Service program moved forward. Research and demonstration activities were more closely coordinated. Experimental work in cooperation with State research agencies was initiated at two new soil- and water-conservation experiment stations. Soil conservation and flood-control survey activities were correlated and administratively grouped in a new Division of Watershed and Conservation Surveys. Erosion reconnaissance work completed during the year supplemented the reconnaissance of 1934–35 and provided the most accurate appraisal to date of erosion conditions in the United States.

New responsibilities assigned to the Service, especially in the field of flood control, increased the scope of cooperative work and materially advanced relationships with other agencies, both inside and outside the Department of Agriculture.

COOPERATIVE RELATIONS AND PLANNING

As cooperation with soil conservation districts began to occupy a place of increased importance in the Service program, and as cooperative working relationships with other agencies progressed, the role of the Division of Cooperative Relations and Planning in maintaining liaison with other governmental agencies and with the public assumed larger proportions.

In cooperation with the Solicitor of the Department, State officials were aided in adapting the standard State soil conservation districts law to the constitutional, legal, and administrative requirements of particular States, as a basis for appropriate State soil conservation legislation; working relationships with the extension services of a number of States were made more effec-

tive and the scope of cooperative activity increased; and coincidental with the progress in district, demonstration, and research activities, appropriate informational material was prepared and disseminated to the public.

COOPERATIVE PLANNING

Long-range planning centered on the development of media and procedures whereby the Service could most effectively cooperate with soil conservation districts established under State laws. To this end, the Section of Cooperative Planning, in cooperation with the Extension Service, assisted districts in the preparation of soil conservation programs and work plans that would serve not only as a sound foundation for district erosion-control activity, but for governmental assistance as well. A suggested standard form for memoranda of understanding between the Department of Agriculture and soil conservation districts was developed, and 32 such memoranda were executed as the basis for Department assistance and cooperation. Procedures were established that enable the Department, through the Service, to make available to districts equipment, materials, Civilian Conservation Corps labor, and other services wherever the need is apparent and available funds permit such assistance.

The Section procured for the use of the Department authenticated copies of the soil conservation districts laws enacted in 25 States. In collaboration with the Office of the Solicitor, it considered the administrative and legal adequacy of each of the laws as a basis for Department cooperation with districts. As in the previous year, the State laws enacted during the year were generally similar to the standard State soil conservation districts law prepared by the Department. Each established a State soil conservation committee, provided a procedure for the establishment of soil conservation districts, and vested certain specified powers in the districts as governmental subdivisions of the State.

A file of current State laws dealing with the conservation of natural resources and the zoning of agricultural lands was maintained by the Section and studied to determine the types of erosion-control activity permissible under existing statutes. Periodically, the Section also prepared and circulated among Department and Service officials timely reports on the progress of States in the enactment of soil conservation district laws and the establishment of districts.

COOPERATIVE RELATIONS IN EXTENSION

Field relationships of the Service took on additional importance. Through the various State extension services and the State soil conservation advisory committees, these relationships were strengthened and broadened. In 27 States, the soil conservation advisory committees prepared and forwarded State soil conservation programs to the Service. These were reviewed by the Section of Cooperative Relations in Extension and subsequently utilized by several of the legally established State soil conservation committees in the development of district plans.

Relationships with State extension services were expanded and improved. Memoranda of understanding with 41 States were renewed, and in 3 other States and Puerto Rico new memoranda were executed. In addition to these memoranda, which outline the general basis for cooperation between the two agencies, annual work plans setting forth in considerable detail the joint responsibilities of the agencies in educational projects for soil conservation were approved in 36 States. Under provisions of the memoranda and work plans, 52 extension conservationists and assistants were employed cooperatively by the 2 Services in 30 States.

In collaboration with county agents, these employees held more than 2,000 educational meetings with farmers' organizations, schools, and various other groups. Tours of soil conservation demonstration farms, projects, and camp areas were conducted, and information on soil conservation and soil conservation districts was made available to the public.

The State extension services, usually through county agents and under the general supervision of extension conservationists, selected 1,072 farms outside of project, C. C. C. camp, and district areas for demonstration purposes. Soil Conservation Service technicians prepared complete soil conservation plans for these farms and as work progressed they became valuable supplements to

Service projects in the demonstration of erosion-control practices and principles.

Representatives of the Section were active in clarifying soil conservation district policies, plans, and procedures for Soil Conservation Service field forces, extension conservationists, college representatives, State soil conservation committees, and district supervisors. In addition, the Section provided assistance to farmer committees and associations organized to develop community interest in soil conservation. While no encouragement was given to the formation of new soil conservation associations, the Section continued its policy of working with associations already formed, especially in the direction of advising, where possible, on details of district organization. At the close of the year, 374 voluntary soil conservation associations were meeting regularly.

INFORMATION

As soil conservation districts were organized and the influence of demonstrations broadened, the demand for information on soil-erosion-control methods increased markedly. To meet these demands and discharge the responsibility of the Service for providing useful, accurate information to the public on soil conservation, an increased amount of material was prepared and disseminated.

This dissemination of information was accomplished by the Section of Information through working relationships with the press and with radio-broadcasting outlets, through the preparation and distribution of bulletins, and through the development and utilization of exhibits, motion pictures, and related media of visual information. In addition, the Section performed a number of functions not strictly of an informational nature, but of general service to the organization, such as the production and processing of photographs, the procurement of printing, binding, and duplicating services, and the procurement and distribution of certain publications.

Toward the close of the year, the Section assumed responsibility for the development of project monographs that would provide a factual account of the establishment, progress, and effectiveness of demonstration projects. Working with a committee composed of representatives from each division of the Service, plans were formulated for the preparation of a standard monograph outline.

Activities of small information staffs in each of the 11 regional offices were supervised by the Section of Information in Washington. Working relationships with extension editors in most States were strengthened and refinements made in the procedures for dissemination of local information. As in the past, the Service utilized to the fullest possible extent established outlets for agricultural information in each State.

PRESS AND RADIO

The Service continued to emphasize the localization of information and the elimination of generalized material in its press and radio activity. Demonstration project and C. C. C. camp offices, working closely with regional information staff members, prepared information having direct local application and more immediate value to individual landowners and operators.

As in the previous year, press releases prepared by the Service totaled approximately 10,000. Most of these were released directly to local newspapers by the project and camp offices. The volume of sporadic radio programs, including talks, interviews, and dramatizations, was materially reduced. However, the number of continuing programs presented at regular intervals was increased in order to establish definite soil conservation radio periods. This development led to the creation of a regular audience for soil conservation broadcasts in several parts of the country. Noteworthy among these new programs was the series of dramatizations inaugurated over WLW, at Cincinnati, Ohio.

As in the field, the Section of Information in Washington attempted, insofar as possible, to regionalize and localize information. For example, the majority of "farm flashes" on soil conservation prepared each week for the radio syndicate service of the Department were regionalized. Previously, the majority of said conservation flashes were prepared for Nation-wide distribution.

During the year the Service began participation in the Department of Agriculture's period of the National Farm and Home Hour on a regular weekly basis. On the same program it also started an irregularly scheduled series of feature broadcasts, emanating from different sections of the country, and presenting the chronological story of each particular section in terms of soil erosion and soil

conservation. In addition, the Service participated on a regular weekly schedule in the Western Farm and Home Hour and in the shorter United States Department of Agriculture program, which replaced the Western Farm and Home Hour at the end of the calendar year.

The Section continued to submit short articles for the Clip Sheet of the Department's Press Service, and both the regional and Washington information staffs prepared feature articles and photographic presentations on various phases of the soil conservation program at the request of newspapers and periodicals.

EDITORIAL

Twelve printed publications were issued during the year and eight other manuscripts were in the process of publication. These 20 publications include 7 farmers' bulletins, 5 miscellaneous publications, 4 unnumbered publications, 3 leaflets, and 1 technical bulletin. Fifteen additional manuscripts were approved for publication by the Department.

Unlike the previous year, when emphasis was placed on the preparation of scientific information of particular value to technical workers, the publication program of the Service for the year was marked by a large increase in the number of practical, popular bulletins to meet the demand of farmers for specific information on methods of erosion control. So great was this demand that supplies of all bulletins issued by the Service were exhausted at one time or another during the year. To meet requests, it was necessary to print 926,375 copies of new bulletins and order 1,037,000 reprints of earlier publications.

Work continued on the preparation of farmers' bulletins dealing with soil conservation in the principal agricultural regions of the country. In this series, two new bulletins appeared: Conserving Corn Belt Soil, and Soil and Water Conservation in the Pacific Northwest. Added to Soil Defense in the Piedmont, published the year before, the bulletins comprise authoritative reference texts on soil conservation for farmers in each of these particular regions. Other publications in the popular field issued during the year were Terracing for Soil and Water Conservation, Wildlife Conservation Through Erosion Control in the Piedmont, The Nichols Terrace: An Improved Channel-Type Terrace for the Southeast, Anchoring Farmlands in the Ohio Valley Region, Erosion Control in the Northeast, and Soil and Water Conservation in the Northern Great Plains.

In addition, the Service prepared Miscellaneous Publication No. 303, Native Woody Plants of the United States, Their Erosion-Control and Wildlife Values; Miscellaneous Publication No. 286, What is Soil Erosion?; Miscellaneous Publication No. 293, Soil Conservation Districts for Erosion Control; Miscellaneous Publication No. 301, Erosion and its Control in Oklahoma Territory; and Technical Bulletin No. 589, Sources of Moisture for Precipitation in the United States.

Nine reports, containing detailed maps and information from erosion surveys on watershed areas in seven States, were prepared for publication.

Soil Conservation, the official organ of the Service, completed its third year of publication. The 12 issues contained 108 signed articles by 79 different authors and also included a large amount of unsigned informational material and administrative notes. Each month the back cover was devoted to diagrammatic drawings or charts emphasizing an idea of technical or administrative importance. The two regular departments, Book Reviews and Abstracts, and For Reference, were continued because of their value as guides to current literature in soil conservation and related fields.

Free distribution to staff members of the Service, officials of the Department, cooperating agencies, libraries, and scientific organizations averaged 5,516 copies per month. The Superintendent of Documents reported 365 paid yearly subscriptions. So large was the demand for free copies, in proportion to the limited supply, that by the end of the year it was impossible to meet more than 5 percent of the requests.

Volume III of Soil Conservation assumed a definite scientific and educational trend during the year, as evidenced by special issues on erosion in foreign countries, districts legislation, and soil conservation research, vegetation especially useful in erosion control, treatments for grass sod and plant cover, and C. C. C. operations in soil conservation. Other subjects given extended treatment included upstream work for flood control, water spreading, roadside erosion control, woodland management, wildlife management, farm planning for soil conservation, sand-dune control, soil microbiology, and contouring, strip cropping, and terracing in the several regions. Sent regularly to 525 deposi-

tory libraries and many research centers, the magazine proved a fruitful source of material for writers of textbooks, bulletins, and articles, and was drawn upon frequently by lecturers and teachers.

Beginning in April, a mimeographed administrative publication entitled "Service News" was issued at intervals of approximately 2 weeks. Distribution was confined to Service staff members.

EDUCATIONAL RELATIONS

In all parts of the country, the interest of educators in soil conservation increased. Requests for teaching material and for cooperation in developing courses and texts on soil conservation were frequent. In Washington and in the regional offices considerable attention was given to this outgrowth of the Service program. General and technical information suitable for teaching purposes in schools and universities, both rural and urban, was furnished on request.

In a number of States, colleges, universities, and teachers' colleges established courses in conservation, with soil conservation included as one of the major phases of the broad subject. Curriculum directors in several States prepared study units on soil conservation for inclusion in public schools, and the Service cooperated in reviewing and providing subject matter. Relationships were developed with such organizations as the Association of School Administrators, the National Education Association, the National Council of Geography Teachers, the Association of American Geographers, the Association of Elementary and High School Science Teachers, and other educational groups of sectional and national importance.

SERVICES

In addition to strictly informational activities, the Section of Information prepared 659 requests for printing and binding work for the entire Service, 300 requests for duplicating work, and 592 requests for special photographic assistance from the central photographic laboratory of the Department.

More than 773,500 copies of publications on soil conservation and related subjects were distributed in cooperation with the Department's Office of Information. In addition, approximately 3,000 reprints and 47,479 mimeographed bulletins and addresses were distributed.

Publications on soil conservation and related subjects issued by other agencies were reviewed and distributed to the Washington and field offices on a selective basis. Approximately 6,240 newspaper clippings from all parts of the country were circulated among the division and section heads. Pertinent legislative material was reviewed and circulated. Mailing lists containing more than 2,240 addresses were maintained. Also, lists of selected available publications on specific subjects were prepared for use as citations or bibliographies to accompany articles and supplement bulletins and exhibits.

VISUAL INFORMATION

The scope of visual information work was broadened. While regional information offices continued the presentation of localized material designed to stimulate local interest in soil conservation, notable advances were made in the preparation and presentation of visual aids intended for sectional and national use.

Two motion pictures were completed and released. Rain on the Plains depicts the wind-erosion problem in the southern Great Plains and shows measures now being used for control. Grassland presents the causes and effects of soil erosion in the Southwest and pictures the control measures utilized to restore vegetation on the range. Three other motion pictures were in various stages of production at the close of the year.

Increased use was made of film strips, not only by Service personnel, but by agencies, schools, clubs, and other private organizations. Ten film strips were released for distribution, and at the close of the year four others were in the process of manufacture. The strips covered various phases of the erosion problem and soil conservation work in all parts of the country.

Libraries of film strips and motion pictures were set up in each of the 11 regional offices. With strips and motion pictures more readily available, mailing problems were reduced and greater use was made of this type of visual material.

Reorganization of the visual information work solved a number of administrative problems in relation to the Washington photographic laboratory and field photographic work. Noteworthy results were increased efficiency in the Washington laboratory and closer working relationships with regional photographers in planning the general photographic program of the Service.

A system of "planned photography" was worked out by most regional photographers during the year. Regional photographers and regional technical personnel established definite photographic programs within each region. As a result, fewer random pictures were taken, but there was a decided improvement in the quality and subject matter of photographs.

Photographic prints, enlargements, negatives developed, and transparencies made by the Washington laboratory totaled 246,452 pieces. Very little work was done outside the Service laboratory. Work was started on a complete classified file of prints, which will permit faster photographic service and bring economies in time and money.

A file of approximately 2,500 slides, many of them colored, was made available for the use of Washington personnel and teachers and educators outside of the Service. Regional and project offices also developed slide libraries. Acceptance of lantern slides by field workers, teachers, and others received considerable stimulation by the development of small 2- by 2-inch natural color slides. A few cameras were purchased in order to produce this type of slide, which is receiving widespread acceptance. It was found that the small natural-color slides were easier to transport, less liable to break, and over a long period of use, less expensive than the larger slides. Also, equipment for showing these slides costs less than large slide equipment.

An illustrations office was established to produce all necessary art and illustrative material, including color work, and to plan small exhibits for field offices. The illustrations office also assisted in the preparation of pictorial and illustrative lay-outs for Service publications.

Service photographs were widely used by newspapers, magazines, book publishers, and in exhibits. Picture mats, released to newspapers and farm journals along with news stories, proved to be an effective means of presenting soil conservation information. In numerous metropolitan newspapers, full-page lay-outs of Service pictures were published in rotogravure sections. The demand for this type of visual material increased steadily.

Exhibit work was de-emphasized to the extent that displays constructed by field offices were small, portable, and inexpensive units that could be used time and time again. Exhibit expenditures were reduced but at no cost to effectiveness of the individual units. Displays were made on 482 separate occasions and were seen by an estimated 9,000,000 persons. All exhibits were shown at small local or semilocal fairs. The Section of Information worked closely with the Division of Exhibits of the Extension Service in the planning and showing of departmental exhibits at State and interstate fairs. A photographic exhibit was placed in the first International Photographic Exposition at New York.

Visual equipment in the field was increased to the point where regional and project offices had available practically every type of equipment necessary for the effective use of pictures, slides, film strips, and motion pictures. This equipment is assigned to field offices in such a way that it can be made immediately available for use in any part of the country on 24 hours notice. Equipment purchased was of the small, readily portable type that can be easily handled and adjusted by even the most inexperienced operator.

A series of 10 pictorial charts, covering every phase of the soil and water conservation program, was planned and turned over to the Government Printing Office. These charts will be made available to lecturers, county agents, teachers, and educators throughout the country as a supplementary part of the Service's cooperative educational work.

OPERATIONS

Field operations of the Service expanded. Eighteen new demonstration projects were established. The influence of the older demonstrations reached a new peak of effectiveness and brought increased requests from individuals and organizations for soil conservation information and assistance. Cooperative working arrangements with 34 soil conservation districts were completed and field work was started in a number of these districts.

The scope of the operations program, directed and supervised by the Division of Conservation Operations, was broadened further by coordination activities of the Department in the field of land use planning. Field work was extended, wherever necessary, to permit cooperation with other agencies of the Department concerned in the use and management of agricultural land. Notable was the work conducted in cooperation with the Farm Security Administration, the Bureau of Agricultural Economics, the Forest Service, and the Bureau of Public Roads.

In 59 demonstration areas, active field operations were concluded. These projects were placed on a sustaining, or maintenance basis, and technical staffs were reduced. At the close of the year, 111 projects were in this category; active operations continuing in the other 55 areas.

As projects shifted to a maintenance basis, increased attention was given to evaluation and detailed examination of the erosion-control measures being used. Revisions and improvements in the practices were worked out wherever necessary in order to meet more completely the requirements of a thorough-going erosion-control program. Field studies and tests were made in cooperation with the Division of Research. Data from individual farms within each project were assembled and all pertinent information of value was brought together in anticipation of a final summarization, or monograph of the project, to be completed at the end of the maintenance period.

With the conclusion of active operations in many project and camp areas, and the new emphasis on cooperation with soil conservation districts, it became evident that some reorganization of field staffs would be necessary. Near the close of the year, plans were made in several regions to subdivide States into a few large soil conservation areas and set up central area staffs to supervise and guide the activities of field technicians located at the various work centers. This step promised more efficient utilization of field personnel. In a number of instances, technicians released from maintenance projects were assigned to C. C. C. work areas in order to speed up farm-planning work. Some technicians were assigned to other agencies, principally the Extension Service and the Farm Security Administration, to assist in planning and supervising the application of erosion-control practices on selected farms. In addition, technical personnel was made available to local soil conservation districts during the latter part of the year to aid in the development and execution of district programs.

With the establishment of a demonstration project in Puerto Rico, the Service began active field operations outside the boundaries of the continental United States for the first time. Technical personnel was assigned to the Puerto Rico Reconstruction Administration to assist with preliminary work and to aid the Division of Research in establishing necessary field studies.

Surveys and plans were developed for the Bureau of Indian Affairs to provide long-time programs of soil conservation for a number of Indian reservations, and assistance was given in launching actual field work.

Run-off studies on 20 small watersheds in different parts of the country were continued in cooperation with the Division of Research, and hydrological studies were continued on 9 watersheds in cooperation with the United States Geological Survey. Subsequently, studies on five of these latter watersheds were discontinued.

Marked progress was made in the technique of planning work, both on private and public lands. There developed a fuller understanding of all the possible measures that could be used and a more accurate application of these measures to fit requirements of the land. Inexpensive natural methods were given greater consideration and more frequent use. Combined with more efficient labor made available during the year, these improvements in the techniques of field operations and planning brought a general reduction in the cost per unit of land treated for soil conservation. To both the Government and the farmer this meant smaller per-unit expenditures and in many cases wider application of soil conservation practices. Throughout the country it improved the acceptability of erosion-control measures and the likelihood of independent erosion-control work.

Field inspection service from Washington was established on a group basis, bringing about a better understanding and closer working relationship between the various technical sections and more effective coordination of field activities. Inspection groups, generally consisting of at least four members representing as many technical sections, inspected typical demonstration projects and camp areas. Acting as a group, they analyzed field work in each area from the stand-

point of a complete and coordinated land use demonstration. Group inspections of this kind were made in all but one region.

Individual members of the Division made special examinations of Service and departmental problems in the field as members of committees which included representatives of other agencies. Division representatives also served on departmental and interdepartmental committees working on problems of national planning, conservation, credit, tenancy, and other matters affecting the agriculture of the Nation.

PRIVATE LAND

By the close of the year, the Service had cooperated with 61,261 farmers and ranchers in more than 500 watershed demonstration projects and areas adjacent to C. C. C. camps in 45 States. Approximately 11½ million acres of privately owned land was involved. Of this total, 5,227,092 acres were originally in cultivation. Under provisions of the cooperative agreements, 867,866 acres will eventually be retired to other uses less conducive to erosion. Surveys showed that 490,070 acres, or more than half the total acreage to be retired, had been converted to other uses in the following manner: 150,420 acres to permanent hay; 235,231 acres to permanent pasture and range; 94,945 acres to woodlands; and 9,474 acres to orchards, vineyards, wildlife habitats, and similar uses.

Survey records further revealed that cooperators were using approved rotations on 2,846,240 acres of cultivated land, were contour-tilling 1,888,554 acres, practicing strip cropping on 770,117 acres, and using winter cover crops on 265,441 acres. In addition, 1,136,553 acres of cultivated land had been terraced as a further safeguard against erosion.

In the semiarid Western States, 441,754 acres of pasture and range land had been contour-furrowed. Other important pasture and range improvements consisted of the installation of 2,920 stock ponds and the development of 668 springs and wells. Approximately 183,887 acres of badly eroded pasture land were converted to woodland.

Approximately 1,684,316 acres of woodland were under soil conservation management at the close of the year. This land included 244,158 acres of new plantations on which the Service had planted 402,952,786 trees and shrubs. The principal treatments given to orchards and vineyards consisted of cover crops on 12,887 acres, construction of 384 miles of terraces and grade ditches, and the improvement of irrigation methods to reduce erosion on 709 acres. In all field activities, the betterment of wildlife conditions was a regular consideration. In addition, 11,798 acres were set aside as special areas for wildlife.

The status of Service conservation operations on private lands, under cooperative agreement with the landowners, is shown in table 1.

TABLE 1.—*Status of private-land program, cumulative, June 30, 1938*

EXTENT OF PROJECTS AND WORK AREAS

Item	Activities of—		Total
	Soil Conservation Service [1]	Civilian Conservation Corps [2]	
Project and work areas—number	[3] 165	[4] 339	504
Do—acres	8,490,649	[5] 10,375,000	18,865,649
Farms in project and work areas—number	64,959	[6] 68,138	133,097
Cooperative agreements signed—acres	3,594,350	7,766,786	11,361,136
Do—number	24,383	36,878	61,261
Cooperative agreements (active)—acres	3,398,727	7,614,547	11,013,274
Do—number	22,938	36,035	58,973

[1] Includes work of Soil Conservation Service and Civilian Conservation Corps on demonstration project areas.
[2] Includes work of Civilian Conservation Corps on work areas outside of project boundaries.
[3] Includes all projects excepting Puerto Rico.
[4] Includes all camps reporting work off demonstration project areas.
[5] Includes an estimated work area of 25,000 acres per camp plus 1,300,000 acres for public-land areas under treatment.
[6] Number of farms estimated for C. C. C. areas.

TABLE 1.—*Status of private-land program, cumulative, June 30, 1938*—Continued

Item	Activities of—		Total
	Soil Conservation Service [1]	Civilian Conservation Corps [2]	
CONDITIONS BEFORE AGREEMENT			
Cultivated land—acres	1,872,523	3,354,569	5,227,092
Clean-tilled crops—do	1,005,263	1,891,431	2,896,694
Erosion-resisting crops—do	351,605	628,951	980,556
Semierosion-resisting crops—do	515,655	834,187	1,349,842
Approved rotations—do	195,100	603,285	798,385
Contour tillage—do	287,864	446,761	734,625
Total terracing—do	60,747	159,522	220,269
Total strip cropping—do	20,050	25,680	45,730
Protected by winter cover crops—do	59,052	190,841	249,893
Cultivated land to be converted to other uses—do	319,990	547,896	867,886
Pasture and range land—do	934,482	3,012,939	3,947,421
Forest range—do	1,149	2,485	3,634
Pasture and range to be converted to other uses—do	68,014	164,730	232,744
Permanent hay land—do	63,434	157,507	220,941
Permanent hay to be converted to other uses—do	7,513	11,639	19,152
Woodland—do	507,430	869,115	1,376,545
Woodland to be converted to other uses—do	12,748	51,737	64,485
Orchard and vineyard—do	16,060	17,869	33,929
Annual cover crops—do	[3] 1,317	[3] 991	[3] 2,308
Perennial cover crops—do	[3] 418	[3] 1,492	[3] 1,910
Orchards to be converted to other uses—do	533	763	1,296
Wildlife—do	182	401	583
Other land—do	200,239	354,386	554,625
Other land to be converted to other uses—do	49,214	57,793	107,007
PROGRAM PLANNED			
Cultivated land—acres	1,595,109	2,852,387	4,447,496
Clean-tilled crops—do	688,587	1,379,319	2,067,906
Erosion-resisting crops—do	449,802	772,655	1,222,457
Semierosion-resisting crops—do	456,720	700,413	1,157,133
Approved rotations—do	1,371,968	2,491,504	3,863,472
Contour tillage—do	1,113,517	2,003,635	3,117,152
Total terracing—do	769,669	1,234,901	2,004,570
Total strip cropping—do	678,437	1,009,498	1,687,935
Protected by winter cover crops—do	184,884	421,558	606,442
Decrease in clean-tilled crops—do	316,676	512,112	828,788
Taken out of cultivation—do	277,414	502,182	779,596
Pasture and range land—do	1,036,760	3,161,521	4,198,281
Forest range—do	1,149	2,485	3,634
Permanent hay land—do	178,195	352,505	530,700
Woodland—do	609,880	1,069,821	1,679,701
Orchard and vineyard—do	16,190	18,240	34,430
Annual cover crops—do	[3] 4,423	[3] 4,584	[3] 9,007
Perennial cover crops—do	[3] 1,543	[3] 2,337	[3] 3,880
Wildlife—do	3,335	6,080	9,415
Other land—do	154,881	306,232	461,113
COOPERATORS PERFORMANCE AS OF DEC. 31, 1937			
Cooperative agreements—number	21,685	31,465	53,150
Do—acres	3,236,263	6,528,224	9,764,487
Cultivated land—do	1,528,389	2,536,603	4,064,992
Clean tilled crops—do	685,905	1,146,911	1,832,816
Erosion-resisting crops—do	345,474	576,623	922,097
Semierosion-resisting crops—do	497,010	813,069	1,310,079
Approved rotations—do	1,090,945	1,755,295	2,846,240
Contour tillage—do	734,279	1,154,275	1,888,554
Combination terracing and strip cropping—do	150,993	188,875	339,868
Total terracing—do	481,121	655,432	1,136,553
Total strip cropping—do	344,606	425,511	770,117
Protected by winter cover crops—do	85,158	180,283	265,441
Decrease in clean-tilled crops—do	243,977	402,258	646,235
Taken out of cultivation—do	186,312	238,482	424,794
Pasture and range land—do	874,677	2,632,527	3,507,204
Forest range—do	61	1,921	1,982
Permanent hay land—do	125,217	178,496	303,713
Woodland—do	560,774	970,311	1,531,085
Orchard and vineyard—do	17,769	13,724	31,493
Wildlife—do	4,625	7,173	11,798
Other land—do	124,812	189,390	314,202

[1] Fiscal-year figures only.

TABLE 1.—*Status of private-land program, cumulative, June 30, 1938*—Continued

OTHER FIELD OPERATIONS COMPLETED CUMULATIVE JUNE 30, 1938

Item	Activities of—		Total
	Soil Conservation Service [1]	Civilian Conservation Corps [2]	
Cultivated land:			
Improved tillage—acres	43,101	19,661	62,762
Contour listing—do	24,282	4,776	29,058
Hummock leveling—do	11,689	1,948	13,637
Pasture and range lands:			
Fertilizing and liming—do	26,721	33,858	60,579
Seeding and sodding—do	94,767	170,243	265,010
Contour furrowing—do	182,320	259,434	441,754
Terracing—do	15,905	24,739	40,644
Stock ponds—number	735	2,185	2,920
Storage of stock ponds—acre-feet	4,131	13,628	17,759
Springs and wells developed—number	108	560	668
Woodlands:			
Placed under management—acres	611,183	1,073,133	1,684,316
Field plantings—do	64,309	97,453	161,762
Gully plantings—do	18,400	59,034	77,434
Windbreak plantings—do	3,386	1,576	4,962
Other plantings—do	8,984	12,592	21,576
Total new plantings—do	95,079	170,655	265,734
Trees planted—number	128,541,769	257,763,368	386,305,137
Shrubs planted—do	18,352,420	23,181,302	41,533,722
Orchards and vineyards:			
Terraces and grade ditches—miles	203	181	384
Improved irrigation methods—acres	[3] 539	[3] 170	[3] 709
Mulching—do	[3] 163	[3] 19	[3] 182
Miscellaneous treatments:			
Total terraces constructed—miles	38,912	43,913	82,825
Diversions—linear feet	4,871,054	11,885,893	16,756,947
Outlet channels—do	5,884,030	13,934,376	19,818,406
Pipe line outlets—do	115,995	67,324	183,319
Outlet structures—number	179,300	145,517	324,817
Grassed drainageways—square yards	24,315,669	39,754,274	64,069,943
Range fences—rods	72,640	133,760	206,400
Other fences—do	1,587,758	4,260,577	5,848,335
Water-impounding reservoirs—number	----------	103	103
Storage of water-impounding reservoirs—acre-feet	----------	73,135	73,135
Gully-bank sloping—square yards	16,364,778	45,751,258	62,116,036
Permanent gully structures—number	23,941	27,226	51,167
Temporary gully structures—do	585,638	1,208,249	1,793,887
Gully seeding and sodding—square yards	101,535,566	134,338,294	235,873,860
Gully mulching—do	4,473,087	22,856,043	27,329,136
Stream channels and bank improvement—linear feet	651,314	2,531,655	3,182,969
Water spreading—acres	14,969	41,384	56,353
Silt-retention structures—number	40	432	472
Highway treatment:			
Protective work under way and completed—miles	35	200	235
Demonstrations under way and completed—do	35	160	195
Structures installed—do	10	30	40
Banks and drainageways vegetated—square yards	21,000	108,000	129,000

PUBLIC-LAND WESTERN WATERSHED PROJECTS

The Service continued to direct an extensive erosion-control and land-management program on four watershed projects located in Western States. These projects are: (1) Navajo, which includes in addition to the entire Navajo Indian Reservation located in Arizona, New Mexico, and Utah, the entire watersheds of the Little Colorado River in New Mexico and the San Juan River in Utah and Colorado; (2) Upper Gila River watershed, including the San Pedro tributary in New Mexico and Arizona; (3) Rio Grande watershed above Elephant Butte Reservoir in New Mexico; (4) the entire Shoshone Indian Reservation in Wyoming. Approximately 80 percent of the land in these watersheds is publicly owned.

Large-scale, integrated planning and operations on a major-watershed basis has been one of the basic premises for the erosion-control and land-management program in these Western States and developments of the past year went far toward advancing the accomplishments and realization of the major watershed approach.

Watershed surveys were carried on over extensive areas in an effort to accumulate all available information concerning the land and water resources of the watershed and the human use of those resources. This material was used to orient the work of existing projects toward the treatment of critical areas and to provide a framework for the orientation of work areas. It also served as a basis for the preparation of State conservation district programs and may be used later in the preparation of preliminary flood-control reports.

Field operations were continued toward reestablishment of the range through a comprehensive program of range management. Reductions in stock to conform to the carrying capacities of the ranges was one of the principal objectives. It is interesting to note that at the time of signing agreements in the watersheds approximately 17 million acres, or 91 percent, of the range land was overstocked. To correct this, a 25-percent reduction in the number of stock and a 23-percent reduction in the animal-months of grazing was required. The establishment of properly located stock-watering places and drift fences was an important feature of the range program. By the close of the year, 838 stock ponds had been constructed, 808 springs and wells developed, and more than 2,050 miles of fence constructed.

Intensive treatment of certain areas to promote the growth of vegetation and to control sheet and gully erosion was continued. Through construction of diversions, dikes, contour furrows, water spreaders, retention dams, and other mechanical structures, marked progress was made in spreading flood-waters and reducing flash flood flows. An outstanding example was found in the Las Cruces, N. Mex., area. A 1-inch rain fell in 40 minutes on two large watersheds between the Organ Mountains and the town of Las Cruces. Previous rains of this order delivered over 1,500 second-feet of water in the form of flash flood down the main arroyo to Las Cruces. On numerous occasions, this flow damaged fields and homes. But in this instance, water-retardation and control measures on the watershed reduced the run-off down the main arroyo to an orderly 200 second-feet that flowed without damage for 7 hours. Stock has been excluded from this critical area for nearly 3 years and such measures as contour furrows, crescents, and various other water-holding and water-spreading devices put into use.

Of special significance to the Rio Grande district in New Mexico was the work of the interdepartmental Rio Grande committee, created primarily to coordinate land use adjustment in the upper Rio Grande watershed. The findings of this committee, and developments which led to the creation of a permanent interdepartmental board, were based largely on the basic surveys, studies, and course of action adopted by the Soil Conservation Service. The final report of the board confirmed in large measure the policies and program of the Service as they concerned the Rio Grande watershed.

Owing to a curtailment in C. C. C. activities, only 16 camps were assisting in the watershed programs at the close of the year. The work areas of four of these camps were located outside the watersheds. The program on these areas, however, was essentially the same as that of the camps working within the watersheds.

The status of public-owned watershed projects is shown in table 2.

TABLE 2.—*Status of four public-land western watershed projects, cumulative, June 30, 1938*

EXTENT OF PROJECTS

Item	Activities of—		Total
	Soil Conservation Service [1]	Civilian Conservation Corps [2]	
Projects—number			4
Do—acres			54, 521, 564
Cooperative agreements signed—do	18, 132, 639	2, 623, 226	20, 755, 865
Do—number	491	303	794
Cooperative agreements (active)—acres	18, 131, 555	2, 593, 150	20, 724, 705
Do—number	484	301	785

[1] S. C. S. on watershed area.
[2] C. C. C. on and off watershed areas.

TABLE 2.—*Status of four public-land western watershed projects, cumulative, June 30, 1938*—Continued

CONDITIONS BEFORE AGREEMENT

Item	Activities of—		Total
	Soil Conservation Service	Civilian Conservation Corps	
Cultivated land—acres	70,962	5,908	76,870
Clean-tilled crops—do	60,369	4,600	64,969
Erosion-resisting crops—do	4,116	531	4,647
Semierosion-resisting crops—do	6,477	777	7,254
Approved rotation—do	1,047	205	1,252
Contour tillage—do	28	206	234
Total strip cropping—do	13	0	13
Protected by winter cover crops—do	4,131	298	4,429
Cultivated land to be converted to other uses—do	2,002	114	2,116
Pasture and range—do	16,296,272	2,574,390	18,870,662
Range overstocked—do	15,154,735	1,930,524	17,085,259
Range not overstocked—do	1,230,647	384,294	1,614,941
Forest range—do	661,690	984	662,674
Pasture and range to be converted to other uses—do	18,460	230	18,690
Permanent hay land—do	1,934	174	2,108
Permanent hay land to be converted to other uses—do	602	0	602
Woodland—do	64	6	70
Orchards and vineyards—do	1,147	44	1,191
Wildlife—do	0	41,776	41,776
Other land—do	1,762,260	928	1,763,188
Other land to be converted to other uses—do	903	135	1,071

PROGRAM PLANNED

Cultivated land—acres	69,731	5,812	75,543
Clean-tilled crops—do	57,587	3,944	61,531
Erosion-resisting crops—do	5,221	933	6,154
Semierosion-resisting crops—do	6,923	935	7,858
Approved rotations—do	13,666	6,063	19,729
Contour tillage—do	12,687	5,380	18,067
Total terracing—do	637	5,335	5,972
Total strip cropping—do	5,335	0	5,335
Protected by winter cover crops—do	13,525	414	13,939
Decrease in clean-tilled crops—do	2,782	656	3,438
Taken out of cultivation—do	1,231	96	1,327
Pasture and range—do	16,278,649	2,574,306	18,852,955
Forest range—do	661,690	791	662,481
Permanent hay—do	3,190	176	3,366
Woodland—do	163	289	452
Orchards and vineyards—do	1,147	39	1,186
Wildlife—do	18,326	41,804	60,130
Other land—do	1,761,433	800	1,762,233

COOPERATORS PERFORMANCE AS OF DEC. 31, 1937

Cooperative agreements—number	350	302	652
Do—acres	17,820,307	2,592,031	20,412,338
Cultivated land—do	66,564	3,570	70,134
Clean-tilled crops—do	54,934	2,033	56,967
Erosion-resisting crops—do	5,094	618	5,712
Semierosion-resisting crops—do	6,536	919	7,455
Approved rotations—do	1,381	405	1,786
Total terracing—do	88	6	94
Total strip cropping—do	90	0	90
Protected by winter cover crops—do	1,413	196	1,609
Decrease in clean-tilled crops—do	2,674	2,153	4,827
Taken out of cultivation—do	617	1,790	2,407
Pasture and range—do	15,968,054	2,549,844	18,517,898
Forest range—do	661,990	791	662,481
Permanent hay—do	1,317	174	1,491
Woodland—do	66	183	249
Wildlife—do	18,296	37,736	56,032
Other land—do	1,766,010	524	1,766,534

TABLE 2.—*Status of four public-land western watershed projects, cumulative, June 30, 1938*—Continued

OTHER FIELD OPERATIONS COMPLETED CUMULATIVE JUNE 30, 1938

Item	Activities of—		Total
	Soil Conservation Service	Civilian Conservation Corps	
Fence constructed—rods	337,012	401,632	738,644
Stock ponds and reservoirs—number	428	411	839
Do—acre-feet	4,758	4,521	9,279
Springs and wells developed—number	244	564	808
Water spreading—acres	96,696	366,785	463,481
Diversion and percolating structures—linear feet	1,081,290	7,790,432	8,871,722
Water-spreading structures—number	[3] 832	[3] 18,061	[3] 18,893
Terraces constructed—miles	392	1,133	1,525
Contour furrows and ridges—acres	2,208	6,090	8,298
Outlet structures—number	142	11,025	11,167
Gully-bank sloping—square yards	926,701	120,932	1,047,633
Permanent gully structures—number	60,030	105,392	174,422
Temporary gully structures—do	375,658	536,519	912,177
Gully seeding and sodding—square yards	4,278,605	70,620,342	74,898,947
Range seeding and sodding—acres	5,791	28,153	33,944
Trees and shrubs planted—do	13,583	3,080	16,663
Trees planted—number	6,592,324	1,580,986	8,173,310
Shrubs planted—do	1,959,889	415,940	2,375,829
Stream channel and bank improved—linear feet	1,657,652	5,908,320	7,565,972
Silt retention structures—number	[3] 265	[3] 125	[3] 390

[3] Fiscal-year figures only.

SOIL CONSERVATION DISTRICTS

Even more significant than the progress made in demonstration areas and public-land projects, was that made by local soil conservation districts organized by farmers under State laws.

Although activity in this field did not start until extremely late in the year, 18 of the 34 districts with which the Service agreed to cooperate, were actively engaged in soil conservation work by July 1. Available reports revealed that the various districts had entered into cooperative agreements with 822 individual farmers and ranchers and had prepared conservation plans for more than 368,000 acres preparatory to the start of actual field operations.

A brief summary of soil conservation district activities, as reported to the Service, is given in table 3.

TABLE 3.—*Status of soil conservation districts program,*[1] *cumulative, June 30, 1938*

Item	Before agreement	Planned	Item	Before agreement	Planned
Cooperative agreements—acres		368,301	Pasture and range—acres	136,910	157,243
Do—number		694	Contour furrows and ridges—acres		5,893
Cultivated land—acres	209,187	190,476	Seeding—do		7,155
Approved rotations—do		188,170	Controlled grazing—do		89,780
Contour tillage—do	19,184	176,537	Permanent hay land—do	1,188	3,364
Strip cropping—do	2,240	29,742	Seeding—do		2,072
Terracing—do	1,732	69,120	Woodland—do	13,585	10,363
Combination strip cropping and terracing—acres		5,835	Field plantings—do		165
Winter cover crops—do	610	126,847	Gully plantings—do		71
Total cropland winter protected—acres	610	128,818	Other plantings—do		83
Cropland winter protected—percent	0.3	67.6	Trees—number		167,675
Taken out of cultivation—acres		18,711	Shrubs—do		1,116
			Protected from grazing—acres	1,544	6,947
			Orchards and vineyards—do	1,260	1,265
			Other land—do	6,171	5,590

[1] Summarized data not available for six districts in North Carolina and South Carolina.

From the outset, cooperation has been a fundamental feature of the Service program. The many fields of agricultural endeavor involved in a coordinated soil conservation program naturally prompted the development of cooperative working relationships with a number of governmental agencies. Cooperation with farmers and ranchers has been of even more immediate and vital importance, for cooperative effort by the farmer and the Service has been the foundation of work in all project and camp areas on privately owned land. In the new soil conservation districts, cooperation is again a basic factor, involving not only the farmer, the district, and the Service, but other cooperating agencies as well.

The desire of farmers to cooperate for soil and water conservation has grown steadily during the past 5 years. Greater interest in the program has been accompanied by a willingness to assume an ever larger share of the cost of cooperative erosion-control work. Service contributions have been limited generally to certain types of labor, equipment not normally available on cooperating farms, and technical service for planning. The cooperators have provided virtually all the supplies and materials necessary for installation of erosion-control measures on their farms.

Table 4 shows the present status of the soil conservation program by regions, projects, and camps.

TABLE 4.—*Soil conservation program by States and regions as of June 30, 1938*

Region, State, and areas	Areas	Gross area	Cooperative agreements		Planned land uses						
					Cultivated	Permanent hay	Pasture or range	Woodland	Orchard and vineyard	Special wildlife	Other
REGION 1											
Connecticut:	*Number*	*Acres*	*Number*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Project	1	69,200	11	756	343	90	141	116	4	0	62
Total		69,200	11	756	343	90	141	116	4	0	62
Delaware:											
Project	1	28,960	11	1,124	408	170	248	210	51	8	29
Total		28,960	11	1,124	408	170	248	210	51	8	29
Maine:											
Project	1	30,000	66	9,474	5,467	611	811	1,862	0	0	723
Total		30,000	66	9,474	5,467	611	811	1,862	0	0	723
Maryland:											
Project	2	66,730	66	5,760	2,751	745	1,049	882	23		310
C. C. C.	3	75,000	247	23,920	9,424	2,210	4,868	6,306	256	29	827
Total		141,730	313	29,680	12,175	2,955	5,917	7,188	279	29	1,137
New Jersey:											
Project	3	71,190	275	23,664	11,962	2,862	2,822	3,857	1,114	10	1,037
C. C. C.	3	75,000	249	31,380	13,350	3,392	4,181	8,241	437	59	1,720
Total		146,190	524	55,044	25,312	6,254	7,003	12,098	1,551	69	2,757
New York:											
Project	3	205,230	514	67,637	21,934	7,319	18,205	16,863	7	44	3,265
C. C. C.	6	150,000	693	91,665	25,900	6,923	33,249	22,633	106	138	2,716
Total		355,230	1,207	159,302	47,834	14,242	51,454	39,496	113	182	5,981
Pennsylvania:											
Project	5	273,926	624	63,630	26,209	4,851	12,562	14,964	240	61	4,743
C. C. C.	8	200,000	836	99,161	41,926	6,926	17,659	24,335	1,284	112	6,919
Total		473,926	1,460	162,791	68,135	11,777	30,221	39,299	1,524	173	11,662

Vermont:											
Project	1	65,250	60	13,249	3,101	560	4,487	4,825	0	18	258
Total		65,250	60	13,249	3,101	560	4,487	4,825	0	18	258
West Virginia:											
Project	2	180,750	576	75,352	6,501	6,673	40,001	10,318	6	1	11,852
C. C. C	7	175,000	621	104,825	17,823	5,303	61,548	15,831	50	22	4,248
Total		355,750	1,197	180,177	24,324	11,976	101,549	26,149	56	23	16,100
Total Project areas	19	991,236	2,203	260,646	78,676	23,881	80,326	53,897	1,445	142	22,279
Total C. C. C. areas	27	675,000	2,646	350,951	108,423	24,754	121,505	77,346	2,133	360	16,430
Total		1,666,236	4,849	611,597	187,099	48,635	201,831	131,243	3,578	502	38,709
REGION 2											
Alabama:											
Project	4	202,879	930	141,172	57,931	5,787	18,468	58,203	30	9	744
C. C. C	10	[1] 350,000	1,520	307,896	143,178	13,914	59,011	90,429	22	93	1,249
Total		552,879	2,450	449,068	201,109	19,701	77,479	148,632	52	102	1,993
Florida:											
Project	2	37,940	217	22,166	12,103	256	4,727	4,884	5	6	185
Total		37,940	217	22,166	12,103	256	4,727	4,884	5	6	185
Georgia:											
Project	5	253,333	1,133	153,376	67,467	4,281	15,147	55,429	0	56	10,996
C. C. C	9	225,000	605	120,714	62,478	5,200	14,591	37,119	6	135	1,185
Total		478,333	1,738	274,090	129,945	9,481	29,738	92,548	6	191	12,181
Mississippi:											
Project	6	327,396	835	139,559	50,470	4,942	33,363	48,077	5	161	2,541
C. C. C	11	275,000	841	169,449	70,607	4,235	46,162	39,934	22	417	8,072
Total		602,396	1,676	309,008	121,077	9,177	79,525	88,011	27	578	10,613
North Carolina:											
Project	8	492,258	2,933	270,953	99,890	7,303	23,080	110,238	27	182	30,233
C. C. C	16	[1] 500,000	3,042	406,233	169,363	5,240	37,900	154,493	343	511	38,383
Total		992,258	5,975	677,186	269,253	12,543	60,980	264,731	370	693	68,616
South Carolina:											
Project	6	282,795	1,620	162,668	83,084	166	15,570	61,592	30	91	2,135
C. C. C	10	[1] 350,000	1,909	323,996	153,352	803	27,886	135,420	271	121	6,143
Total		632,795	3,529	486,664	236,436	969	43,456	197,012	301	212	8,278

[1] Includes an estimated 100,000 acres additional work area for work done by abandoned camps.

TABLE 4.—*Soil conservation program by States and regions, as of June 30, 1938*—Continued

Region, State, and areas	Areas	Gross area	Cooperative agreements		Planned land uses						
					Cultivated	Permanent hay	Pasture or range	Woodland	Orchard and vineyard	Special wildlife	Other
REGION 2—continued											
Virginia:	*Number*	*Acres*	*Number*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Project	4	291,800	784	105,895	30,059	2,615	13,474	53,792	300	36	5,619
C. C. C	9	225,000	1,233	224,110	57,464	7,906	33,579	114,024	438	260	10,439
Total		516,800	2,017	330,005	87,523	10,521	47,053	167,816	738	296	16,058
Total project areas	35	1,888,401	8,452	995,789	401,004	25,350	123,829	392,215	397	541	52,453
Total C. C. C. areas	65	1,925,000	9,150	1,552,398	656,442	37,298	219,129	571,419	1,102	1,537	65,471
Total		3,813,401	17,602	2,548,187	1,057,446	62,648	342,958	963,634	1,499	2,078	117,924
REGION 3											
Indiana:											
Project	3	92,799	145	16,164	6,324	1,537	5,098	2,409	15	1	780
C. C. C	8	200,000	997	147,637	58,262	12,411	52,543	18,119	179	119	6,004
Total		292,799	1,142	163,801	64,586	13,948	57,641	20,528	194	120	6,784
Kentucky:											
Project	3	83,880	347	31,266	14,391	3,105	9,392	3,532	4	2	840
C. C. C	10	250,000	1,382	222,107	118,345	15,426	55,271	23,300	334	184	9,247
Total		333,880	1,729	253,373	132,736	18,531	64,663	26,832	338	186	10,087
Michigan:											
Project	2	70,780	149	9,602	4,913	867	1,505	942	842	55	478
Total		70,780	149	9,602	4,913	867	1,505	942	842	55	478
Ohio:											
Project	5	260,444	674	83,723	28,357	4,830	33,444	10,823	20	50	6,199
C. C. C	12	300,000	1,819	274,090	117,154	14,539	82,833	36,891	611	59	22,003
Total		560,444	2,493	357,813	145,511	19,369	116,277	47,714	631	109	28,202
Tennessee:											
Project	2	62,890	104	10,401	6,072	792	1,380	1,243	28	107	779
C. C. C	7	175,000	326	66,797	35,440	5,973	15,476	7,876	63	54	1,915
Total		237,890	430	77,198	41,512	6,765	16,856	9,119	91	161	2,694

Total project areas	15	570,793	1,419	151,156	60,057	11,131	50,819	18,949	909	215	9,076
Total C. C. C. areas	37	925,000	4,524	710,631	329,201	48,349	206,123	86,186	1,187	416	39,169
Total		1,495,793	5,943	861,787	389,258	59,480	256,942	105,135	2,096	631	48,245
REGION 4											
Arkansas:											
Project	7	324,695	1,070	135,239	41,948	10,661	36,680	39,752	0	44	6,154
C. C. C.	12	[1] 400,000	2,182	340,640	101,121	24,961	103,134	100,626	0	229	10,569
Soil conservation districts	10	3,822,046	324	41,462	9,879	3,292	16,724	9,260	1,265		1,042
Total		4,546,741	3,576	517,341	152,948	38,914	156,538	149,638	1,265	273	17,765
Louisiana:											
Project	6	226,941	850	124,140	51,197	1,517	25,202	43,520	0	489	2,215
C. C. C.	11	[1] 375,000	1,379	278,434	100,447	2,802	66,835	102,745	0	580	5,025
Total		601,941	2,229	402,574	151,644	4,319	92,037	146,265	0	1,069	7,240
Texas:											
Project	9	506,825	1,427	195,453	119,381	3,277	59,712	8,869	0	96	4,118
C. C. C.	21	[1] 625,000	2,775	524,417	268,778	7,974	221,339	13,949	0	637	11,740
Total		1,131,825	4,202	719,870	388,159	11,251	281,051	22,818	0	733	15,858
Total project areas	22	1,058,461	3,347	454,832	212,526	15,455	121,594	92,141		629	12,487
Total C. C. C. areas	44	1,400,000	6,336	1,143,491	470,346	35,737	391,308	217,320		1,446	27,334
Total soil conservation districts	10	3,822,046	324	41,462	9,879	3,292	16,724	9,260	1,265		1,042
Total		6,280,507	10,007	1,639,785	692,751	54,484	529,626	318,721	1,265	2,075	40,863
REGION 5											
Illinois:											
Project	3	214,081	731	118,366	85,428	5,836	20,533	1,750	96	143	4,580
C. C. C.	21	525,000	2,004	300,961	157,978	23,893	82,978	22,507	585	209	12,811
Total		739,081	2,735	419,327	243,406	29,729	103,511	24,257	681	352	17,391
Iowa:											
Project	5	195,073	869	132,024	88,622	7,239	27,648	1,603	10	87	6,815
C. C. C.	17	425,000	1,810	278,979	148,106	20,450	87,734	6,722	6	115	15,846
Total		620,073	2,679	411,003	236,728	27,689	115,382	8,325	16	202	22,661
Minnesota:											
Project	4	113,882	391	51,180	23,216	4,955	14,032	6,618	0	124	2,235
C. C. C.	8	200,000	677	113,947	46,222	11,870	36,413	14,566	3	41	4,832
Total		313,882	1,068	165,127	69,438	16,825	50,445	21,184	3	165	7,067

[1] Includes an estimated 100,000 acres additional work area for work done by abandoned camps.

TABLE 4.—*Soil conservation program by States and regions, as of June 30, 1938*—Continued

Region, State, and areas	Areas	Gross area	Cooperative agreements		Planned land uses						
					Cultivated	Permanent hay	Pasture or range	Woodland	Orchard and vineyard	Special wildlife	Other
REGION 5—continued											
Missouri:	*Number*	*Acres*	*Number*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Project	4	231,397	1,102	156,769	55,520	20,590	70,962	3,048	208	441	6,000
C. C. C.	17	425,000	1,729	289,250	117,180	28,177	122,930	7,472	154	232	13,105
Total		656,397	2,831	446,019	172,700	48,767	193,892	10,520	362	673	19,105
Wisconsin:											
Project	3	150,289	558	64,158	23,458	3,285	20,311	14,802	3	111	2,188
C. C. C.	13	325,000	973	168,607	55,816	17,277	63,185	25,932	2	221	6,174
Total		475,289	1,531	232,765	79,274	20,562	83,496	40,734	5	332	8,362
Total project	19	904,722	3,651	522,497	276,244	41,905	153,486	27,821	317	906	21,818
Total C. C. C.	76	1,900,000	7,193	1,151,744	525,302	101,667	393,240	77,199	750	818	52,768
Total		2,804,722	10,844	1,674,241	801,546	143,572	546,726	105,020	1,067	1,724	74,586
REGION 6											
Colorado:											
Project	4	421,560	272	159,811	38,436	762	116,876	766	0	242	2,729
C. C. C.	8	[2] 300,000	343	278,081	35,844	4,632	231,196	2,253	0	522	3,634
Total		721,560	615	437,892	74,280	5,394	348,072	3,019	0	764	6,363
Kansas project No. 4	1	52,000	69	25,188	18,201		6,506				481
New Mexico project Nos. 4 and 9	2	99,520	100	44,601	20,958	26	22,324	207	0	15	1,071
Oklahoma project No. 9	1	33,920	65	14,840	12,082		2,206	42	0		510
Texas:											
Project	5	248,170	237	137,560	87,874	20	47,791	100	0	107	1,668
C. C. C.	5	[3] 525,000	627	500,134	191,611	160	303,804	557	0	32	3,970
Soil conservation districts	1	6,807,593	328	321,972	177,623		139,861				4,488
Total		7,580,763	1,192	959,666	357,108	180	491,456	657	0	139	10,126
Total project areas	13	855,170	743	382,000	177,551	808	195,703	1,115	0	364	6,459
Total C. C. C. areas	13	825,000	970	778,215	227,455	4,792	535,000	2,810	0	554	7,604
Soil conservation districts	1	6,807,593	328	321,972	177,623		139,861				4,488
Total		8,487,763	2,041	1,482,187	582,629	5,600	870,564	3,925	0	918	18,551

REGION 7											
Kansas:											
Project	3	194,157	519	99,398	58,032	1,643	33,792	1,440	0	18	4,473
C. C. C	7	175,000	504	125,009	42,042	9,452	60,225	1,442	0	66	11,782
Total		369,157	1,023	224,407	100,074	11,095	94,017	2,882		84	16,255
Nebraska:											
Project	3	104,434	248	45,067	33,734	1,465	7,096	589	0	2	2,181
C. C. C	13	325,000	1,219	234,996	141,227	29,243	52,478	5,280	0	27	6,741
Total		429,434	1,467	280,063	174,961	30,708	59,574	5,869	0	29	8,922
Oklahoma:											
Project	9	490,822	1,854	251,550	105,263	15,819	112,874	5,088	0	297	12,209
C. C. C	24	600,000	2,974	446,896	202,172	23,709	152,711	11,455	0	471	56,378
Total		1,090,822	4,828	698,446	307,435	39,528	265,585	16,543	0	768	68,587
Total project areas	15	789,413	2,621	396,015	197,029	18,927	153,762	7,117	0	317	18,863
Total C. C. C. areas	44	1,100,000	4,697	806,901	385,441	62,404	265,414	18,177	0	564	74,901
Total		1,889,413	7,318	1,202,916	582,470	81,331	419,176	25,294	0	881	93,764
REGION 8											
Colorado:											
C. C. C. areas	1	25,000	24	14,106	1,339	500	10,986	173	7	0	1,101
Total		25,000	24	14,106	1,339	500	10,986	173	7	0	1,101
Utah:											
Project	2	208,640	108	33,974	1,035	386	32,402	9	0	0	142
C. C. C	5	125,000	88	87,812	1,131	489	77,899	7,539	0	0	754
Total		333,640	196	121,786	2,166	875	110,301	7,548	0	0	896
WATERSHED											
Gila (Ariz. and N. Mex.):											
Soil Conservation Service	1	11,627,520	129	1,043,951	2,491	0	1,041,063	30	0	0	367
C. C. C			217	1,934,540	0	0	1,934,540	0	0	0	0
Total		11,627,520	346	2,978,491	2,491	0	2,975,603	30	0	0	367
Navajo (Ariz. and N. Mex.):											
Soil Conservation Service	1	24,514,975	8	15,208,094	44,109	110	13,384,527	0	1,133	18,293	1,759,922
C. C. C			25	19,302	1,092	5	17,182	289	21	75	638
Total		24,514,975	33	15,227,396	45,201	115	13,401,709	289	1,154	18,368	1,760,560

[2] Includes an estimated 100,000 acres additional work area for camps working on public-land agreements.
[3] Includes an estimated 400,000 acres additional work area for camps working on public-land agreements.

TABLE 4.—*Soil conservation program by States and regions, as of June 30, 1938*—Continued

Region, State, and areas	Areas	Gross area	Cooperative agreements		Planned land uses						
					Cultivated	Permanent hay	Pasture or range	Woodland	Orchard and vineyard	Special wildlife	Other
	Number	*Acres*	*Number*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Rio Grande (N. Mex.):											
Soil Conservation Service	1	16,109,000	293	1,248,957	21,460	208	1,226,684	0	14	0	591
C. C. C.			61	669,384	4,720	171	622,584	0	18	41,729	162
Total		16,109,000	354	1,918,341	26,180	379	1,849,268	0	32	41,729	753
Total project areas	2	208,640	108	33,974	1,035	386	32,402	9	0	0	142
Total C. C. C. areas	6	150,000	112	101,918	2,470	989	88,885	7,712	7	0	1,855
Total watershed	3	52,251,495	733	20,124,228	73,872	494	18,226,580	319	1,186	60,097	1,761,680
Total		52,610,135	953	20,260,120	77,377	1,869	18,347,867	8,040	1,193	60,097	1,763,677
REGION 9											
Montana:											
Project	2	64,023	136	44,530	32,338	4,301	6,626	414	0	2	849
C. C. C.	1	25,000	13	8,809	551	1,156	4,391	0	0	0	2,711
Total		89,023	149	53,339	32,889	5,457	11,017	414	0	2	3,560
North Dakota:											
Project	2	100,280	132	32,556	18,659	4,726	6,593	2,022	0	1	555
C. C. C.	1	25,000	84	15,746	8,520	1,804	4,107	572	0	0	743
Total		125,280	216	48,302	27,179	6,530	10,700	2,594	0	1	1,29
South Dakota:											
Project	3	238,600	330	83,179	48,501	7,722	24,928	1,579	0	45	404
C. C. C.	4	100,000	186	57,630	20,474	9,373	25,155	885	0	19	1,724
Total		338,600	516	140,809	68,975	17,095	50,083	2,464	0	64	2,128
Wyoming 2:											
Project	1	109,500	57	28,729	3,506	62	24,472	211	0	0	478
WATERSHED											
Shoshone (Wyo.) Soil Conservation Service	1	2,270,069	61	631,637	1,671	2,872	626,375	133	0	33	553
Total project areas	8	512,403	655	188,994	103,004	16,811	62,619	4,226	0	48	2,286
Total C. C. C. areas	6	150,000	283	82,185	29,545	12,333	33,653	1,457	0	19	5,178
Total watershed	1	2,270,069	61	631,637	1,671	2,872	626,375	133	0	33	553
Total		2,932,472	999	902,816	134,220	32,016	722,647	5,816	0	100	8,017

REGION 10											
California:											
Project	8	252,870	561	48,448	15,303	65	9,131	8,409	12,106	144	3,290
C. C. C	7	175,000	301	47,099	11,251	339	16,545	2,064	13,033	349	3,518
Total		427,870	862	95,547	26,554	404	25,676	10,473	25,139	493	6,808
Nevada:											
Project	2	114,990	30	1,149	263	379	507	0	0	0	0
C. C. C	1	25,000	30	1,750	473	300	918	22	0	0	37
Total		139,990	60	2,899	736	679	1,425	22	0	0	37
Total project areas	10	367,860	591	49,597	15,566	444	9,638	8,409	12,106	144	3,290
Total C. C. C. areas	8	200,000	331	48,849	11,724	639	17,463	2,086	13,033	349	3,555
Total		567,860	922	98,446	27,290	1,083	27,101	10,495	25,139	493	6,845
REGION 11											
Idaho:											
Project	1	51,000	79	29,645	1,434	5,746	21,560	110	0	6	789
C. C. C	4	100,000	282	87,085	29,952	7,598	43,829	3,540	11	5	2,150
Total		151,000	361	116,730	31,386	13,344	65,389	3,650	11	11	2,939
Oregon:											
Project	3	112,320	142	42,702	15,592	1,584	20,230	1,098	1,016	0	3,182
C. C. C	3	[4] 875,000	104	836,321	28,385	1,737	801,659	41	0	0	4,499
Total		987,320	246	879,023	43,977	3,321	821,889	1,139	1,016	0	7,681
Washington:											
Project	3	180,230	372	86,503	55,391	15,767	10,792	2,773	0	23	1,757
C. C. C	6	150,000	250	116,097	47,701	14,208	44,313	4,528	17	12	5,318
Total		330,230	622	202,600	103,092	29,975	55,105	7,301	17	35	7,075
Total project areas	7	343,550	593	158,850	72,417	23,097	52,582	3,981	1,016	29	5,728
Total C. C. C. areas	13	1,125,000	636	1,039,503	106,038	23,543	889,801	8,109	28	17	11,967
Total		1,468,550	1,229	1,198,353	178,455	46,640	942,383	12,090	1,044	46	17,695
Grand total:											
Project areas (private)	165	8,490,649	24,383	3,594,350	1,595,109	178,195	1,036,760	609,880	16,190	3,335	154,881
C. C. C. areas (private)	339	10,375,000	36,878	7,766,786	2,852,387	352,505	3,161,521	1,069,821	18,240	6,080	306,232
Soil conservation districts	11	10,629,639	652	363,434	187,502	3,292	156,585	9,260	1,265	0	5,530
Watersheds	4	54,521,564	794	20,755,865	75,543	3,366	18,852,955	452	1,186	60,130	1,762,233
Total	519	84,016,852	62,707	32,480,435	4,710,541	537,358	23,207,821	1,689,413	36,881	69,545	2,228,876

[4] Includes an estimated 800,000 acres additional work area for camps working on public-land agreements.

CIVILIAN CONSERVATION CORPS OPERATIONS

General curtailment of C. C. C. activities led to a considerable reduction in the number of C. C. C. camps assigned to soil conservation activity. The average number of camps operating under technical supervision of the Service dropped from 440 to 384, with only 360 actively engaged in soil conservation work at the close of the year.

Table 5 gives the Soil Conservation Service's quota of camps, personnel, and enrollees by quarters, as of June 30, 1938.

TABLE 5.—*Camps, personnel, and enrollees supervised by the Soil Conservation Service, fiscal year 1938*

Date	Camps operated	Personnel	Enrollees [1]	Date	Camps operated	Personnel	Enrollees [1]
	Number	*Number*	*Number*		*Number*	*Number*	*Number*
July 1, 1937	419	4,267	59,366	Apr. 1, 1938	361	4,179	63,322
Oct. 1, 1937	405	4,171	54,492	June 30, 1938	360	4,142	59,491
Jan. 1, 1938	373	4,154	67,822	Average	384		60,491

[1] Average number of enrollees per camp, 159.

Field operations in work areas adjacent to C. C. C. camps were essentially the same as those performed on watershed demonstration projects, although on a somewhat larger scale. The Service entered into cooperative agreements with farmers and ranchers in each area and provided a technical staff to supervise and direct the execution of individual farm plans by enrollee labor.

Activities of the C. C. C. included the planting of trees, grass, and shrubs on steep slopes or badly eroded areas retired from cultivation; the building of check dams in gullies; the construction of farm ponds; the contour furrowing of range and pasture land to conserve moisture; the seeding and sodding of terrace outlets; the laying out of fields for strip cropping and contour cultivation; woodland improvement; and other work related to the conservation of soil and water resources.

C. C. C. operations were completed during the year on some 340,000 acres, or approximately three times as much land as was similarly treated in watershed demonstration areas.

In addition to directing the work program, the Service also had responsibility for the instruction of C. C. C. enrollees in soil conservation and related job training. This instruction was designed, on the one hand, to make enrollees conscious of the dangers of erosion and to teach them how to conserve soil and water resources; and on the other hand, to make them more efficient workmen while in camp and more employable upon discharge. Most enrollees attended classes in soil conservation and many were responsible for the spread of conservation practices, particularly those from farm homes. Some who rented farms after discharge from camp made practical use of their soil conservation training. Others were employed as farm managers or superintendents by owners who wished to have erosion-control practices instituted on their farms. A total of 669 former enrollees, 124 in technical work and 545 nontechnical, found employment in the Service itself.

The safety record of C. C. C. camps under Service supervision was appreciably improved. The accident frequency during the year ended June 30, 1937, was 25.75 per million man-hours of exposure. The frequency through May 1938, decreased to 18.44, a rate considerably lower than for the Corps as a whole. Forty-four camps operated throughout the year without experiencing a single lost-time accident.

In addition to work in connection with the control of soil erosion, practically all camps engaged in some form of emergency work. Enrollees were called on to search for missing persons, to rescue flood and blizzard victims, and to fight fire. Probably the outstanding emergency service was that given in Colorado and adjoining States in connection with grasshopper eradication.

Weather conditions sometimes interfered with work operations, and at these times, whenever possible, the Service arranged to loan men to other using agen-

cies that had different types of work to perform or had camps located in areas where climatic conditions were more favorable at the time. Enrollees were loaned from Service camps to the Forest Service, National Park Service, Division of Grazing, and Bureau of Agricultural Engineering.

EROSION-CONTROL PRACTICES

Relations between the Service and cooperating farmers were materially strengthened by activities of the Section of Erosion Control Practices. As more adequate economic and social information became available and improvements were made in erosion-control techniques, individual farm plans were revised to provide more practical and economically sound programs of soil conservation for each cooperating farm.

Farm plans were simplified by omitting considerable detail from the land use map and by showing the cropping sequence in a tabular form that could be more easily read. Summaries were added to show the total acreage of each crop, together with a concise outline of the various conservation practices to be utilized. A work sheet was also provided to show the probable production of the different types of crops. This estimate was balanced against the farm livestock requirements for grain, hay, and pasture. The improved plan enabled the farmer to regulate his farm enterprise in such a way as to take maximum advantage of his conservation program and at the same time adapt livestock programs to probable production.

By checking cooperative agreements in the Washington and regional offices, the Section brought about a closer adherence to established policies and programs of the Service, and greater uniformity and coordination in both the procedures used and the content of the farm plans. There also resulted a considerable increase in the contributions made by cooperating farmers and ranchers. The type and completeness of economic and social information relative to areas and farms, together with physical information needed in developing farm and ranch plans, was decidedly improved during the year.

More than 9,000 new cooperative agreements, involving approximately 13½ million acres, were signed. In addition, more than 23,000 amendments were made to former agreements to refine and improve the work already under way.

In cooperation with the Extension Service, representatives of the Section played an important part in bringing about a spread of practices beyond the boundaries of project and camp areas. The Extension Service selected representative farms, and soil conservationists, with the aid of other technicians, planned complete soil conservation programs which the farmers agreed to carry out.

Cooperation with soil conservation districts during the latter part of the year caused the transfer of considerable personnel to districts to supervise the preparation of farm plans and to assist in cooperative agreements between the farmers and district supervisors. A sampling of these district agreements was reviewed by the Section of Erosion Control Practices to determine the adequacy of proposed measures in the light of a complete and coordinated program.

COOPERATIVE AGREEMENT REVIEW

A more detailed and systematic review of cooperative agreements was made possible by increasing personnel in the Washington office of the Section of Erosion Control Practices. All agreements were sorted on a regional, project, and camp basis and adequate samples selected for detailed review. It was possible with this system to secure information for all areas and also to determine by cumulative records those areas which were in special need of assistance in developing cooperative agreements.

Agreements were reviewed to determine their conformity with policies and plans of the Service, the degree to which each plan applied the approved procedures set forth in the individual project work programs, and the adequacy with which the various technical practices were coordinated into a complete plan of soil conservation farming. The factual information secured by the soil conservation and farm-management surveys of each farm was considered in relation to the erosion-control program planned for the farm.

In cases where it was evident that the plan was outstandingly successful as a complete and coordinated program of soil conservation and in showing the

development of new techniques of erosion control, this progress was reported for the guidance and improvement of cooperative agreements in comparable areas. In other cases where there were apparent weaknesses in the plans, or deviations from national policies and approved procedures, this information was transmitted to the field and additional attention given to problems of farm planning and the preparation of cooperative agreements.

In these ways, marked improvement in farm planning and in effectuation of national policies and plans was achieved. The cooperative-agreement review not only helped improve subsequent cooperative agreements, but also prompted beneficial revisions and amendments of those previously written.

Agreements were also reviewed in the regional offices, and project personnel detailed to assist in this regional review work. Improvement in the technical quality of cooperative agreements brought about by regions permitted the Washington staff to give more attention to the coordination of national policies relating to erosion-control practices.

FARM MANAGEMENT

Definite progress was made in obtaining and utilizing economic information needed in planning soil conservation programs for demonstration areas, C. C. C. camp work areas, and for individual farms. Special emphasis was laid on two phases of this work: (1) Collection and use of specific economic information, on an area basis in preparing programs and work plans for areas, and (2) collection of economic information from individual farms for use in fitting work plans of an area to the needs of the individual farm.

The first type of information was obtained by making surveys of a representative sample of farms in an area. As a rule, such surveys were conducted by the Division of Operations in cooperation with representatives of the State colleges of agriculture or experiment stations. In a number of cases, the Division of Research assisted in conducting these studies. Such surveys were made on a total of 103 project or camp areas. Specific information on individual farms was obtained by surveys regularly made prior to preparation of cooperative agreements.

Considerable progress was made in the development of methods of summarizing, analyzing, and interpreting economic information, and correlating economic with physical data. Studies made early in the history of the Service utilized the more or less orthodox methods of grouping and analysis. While these methods gave a good picture of conditions at the time, they afforded comparatively little information useful in developing beneficial future changes in farm organization. Considerable attention was given, therefore, to improved techniques of analysis of data and especially to the correlation of physical and economic data.

Progress in the use of economic information to improve the soil conservation of individual farms or ranches was brought about primarily through the use of a farm-management work sheet. Previously, the use of such a work sheet was common in only three or four regions. During the year it was adopted in all regions. This sheet presents the land use, type of farming, kinds and amounts of crops grown, disposition of crops, and kinds and amounts of livestock on the farm previous to the development of the plan. After the soil conservation farm plan is developed, information on the organization of the farm and the acreages of various crops to be produced is recorded on the work sheet. It also shows to what extent the crops produced under the soil conservation farming program plan will supply the feed needed for livestock and what, if any, changes have been made in the acreages of cash crops. The use of this work sheet probably assisted more than any other one device in improving the economic soundness and feasibility of individual farm plans.

Repeat studies were made of the farm-account records kept in various areas in order to determine how the farm plans fitted in with the economic needs of the farmer and what, if any, changes were necessary. This work was conducted largely in cooperation with the various colleges of agriculture and in some cases in cooperation with the Division of Research.

Another outstanding reason for improvement in the economic soundness of soil conservation plans was the increase in trained personnel on both regional and project staffs. All but two regions had men specially trained in farm management on their regional staffs at the close of the year.

AGRONOMY AND RANGE MANAGEMENT

As the field-operations program advanced, it became more and more apparent that effective soil and water conservation can be achieved most practically and economically through the use of vegetative-control measures. As a consequence, greater emphasis than ever before was placed on agronomic and range-management practices.

New and better crop rotations were developed to fit the particular needs of various regions; cultivated fields suffering from severe erosion were retired to grass or other protective vegetation; pastures and range lands were improved by liming, fertilizing, and adjusting grazing to productive capacity. The use of cover crops gained widespread popular support in a number of agricultural regions. Vegetation also came into more widespread use to supplement engineering structures such as terraces, diversion ditches, and check dams in gullies.

Considerable progress was made in establishing vegetative waterways in connection with strip cropping and terracing. In the South, *Lespedeza sericea* and kudzu were extensively used for this purpose. Cheaper methods of establishing vegetation, particularly Bermuda grass, in outlet channels, were developed. Efforts were made to take advantage of natural waterways which could be developed into productive meadow or pasture land, and at the same time serve as outlets for surplus run-off.

CROPLAND MANAGEMENT

The growing regard for agronomic measures led to definite changes in cropping practices and a significant reduction in the acreage of clean-tilled crops. By the close of the year, almost 500,000 of the 5,227,000 acres of cultivated land under cooperative agreement had been retired to uses considerably less conducive to erosion.

The increase in acreage devoted to winter cover crops for soil protection and improvement was perhaps most noticeable in the Southern States. On some projects, the increase amounted to more than 100 percent. A significant development was the planting of a number of crops formerly little used. Among these was early southern giant bur-clover. Because of its early-maturing qualities, prolific vegetative growth, and its value as an erosion-control and soil-improving crop, many farmers planted this crop for winter cover and also established seed plots to insure ample supplies of seed for future use. Similarly, there was a marked increase in the production of crimson clover and crotalaria seed.

Refinements in the practice of strip cropping emphasized the need for staying closer to the contour, both at the top and bottom of the strips. In the Cotton Belt, the development of permanent strip cropping was an outstanding accomplishment of the year. In many instances, perennial strips were used to protect sections of fields that were not particularly steep but were so located as to be subject to severe erosion. Permanent strips were also used to break long slopes, particularly where there was a change in slope, usually near the center of the field. Such strips were used on terraced fields in numerous instances, with every third terrace interval being planted to permanent vegetation. In portions of the Great Plains, excellent progress was made with alfalfa-bromegrass mixtures in contour buffer strips which served to check run-off. The buffer strips were also used as guide lines for contour-tillage operations. Border and turn strips were developed in numerous instances adjacent to engineering structures and at other points in field boundaries.

In the bean-growing dry-farm areas of New Mexico there was a more general acceptance of contour strip cropping, not only as an individual practice, but in combination with terraces. In addition to increased wind-erosion control, the adoption of strip-cropping practices in the bean-growing areas made a system of rotation possible and also helped improve many farm pastures by bringing about a better balance between feed and forage supply and the livestock units on the farm.

The amount of grass included in mixtures of alfalfa and other legumes was greatly increased both in rotation and permanent meadows. Such mixtures proved to be much more valuable in insuring good meadow stands and also in increasing the organic matter of the soil. Considerable progress was made in the development of grass and legume silage in the northeastern and middlewestern regions. This development was particularly valuable in providing good feed during the summer months when permanent pastures were unproductive. It also decreased the acreage of corn necessary for winter feed.

There was marked development of new and better crop rotations which would regularly and systematically restore qualities of stability and fertility to the soil. Advancements along this line were unusually valuable in regions where the larger part of the cultivated land had been essentially under a one-crop system for many years. In these regions, the introduction and subsequent widespread adoption by farmers of sound crop rotations, not only furthered the soil and water conservation program, but in a number of instances, inaugurated entirely new and more stable systems of agriculture.

Marked progress was also made in lengthening rotations so as to reduce the amount of clean-tilled crops and increase the amount of soil-holding crops. In this connection, practically all approved rotations including small grain, and mixed grass and legume sod along with clean-tilled crops.

ORCHARD MANAGEMENT

One of the outstanding developments in connection with erosion control on orchard lands was the increased use of cover crops. On the Pacific coast, permanent cover was established in both deciduous orchards and citrus groves where clean cultivation or the use of annual cover crops had been established practices in the past. The application of fertilizer or manure to orchard cover crops became a standard practice in some sections. There was also a marked increase in the number of young orchards planted on the contour of steep slopes where erosion was a potential menace. The practice of mulching was expanded considerably. It gave unusual promise as a preliminary control measure in orchards where vegetation could not be adequately grown because of soil type, shade, or type of fruit production. This was especially true in peach orchards and in berry fields in New Jersey, where it not only increased the yield of berries but decreased the occurrence of disease. Clean cultivation of vineyards has long been considered necessary in the production of grapes, but in California it was found that annual volunteer cover or green-manure crops, treated with fertilizer or manure, were effective in controlling wind and water erosion in vineyards.

PASTURE MANAGEMENT

With the retirement of considerable acreage from cultivation, increased attention was given to the development of new pastures and meadows. At the same time, continued efforts were made to build up and improve old pastures.

In many sections, supplementary pastures were provided to insure adequate livestock feed throughout the growing season. Water facilities were provided in each pasture wherever possible. Farmers were encouraged to cut weeds at the proper time and to provide soil amendments when needed.

The use of contour furrowing was increased, and new conservation methods were developed. In establishing new pastures and in the renovation of old pastures, a system of contour furrowing was devised which left a series of furrows and ridges adjacent to one another in the field. This was accomplished by backfurrowing and dead furrowing with a plow. It resulted in shallow, wider, flat-bottomed furrows that conserved moisture over nearly the whole surface of the pasture rather than in narrow ribbons. By preparing the furrows coincidentally with the plowing and preparing of the seedbed, their construction involved small additional cost. In some soils the same result was obtained by disking back and forth on the contour in the same path, with the disk set to throw the soil outward until shallow furrows were formed. These furrows gave promise of considerable value, since the ridges were low and could be mowed easily to control weeds.

Contour furrowing continued to be one of the most popular soil conservation pasture practices among farmers, since its value in preventing soil loss and run-off was readily apparent. Contour furrows were also particularly effective in preventing the development of gullies and in helping to heal old gullies.

RANGE MANAGEMENT

The major development in range management was the adoption of standard methods of range survey, known as the western range survey standards. This standardization, established through an agreement among all agencies concerned with the use and management of range lands, permitted the free exchange and

interpretation of survey data between agencies and brought about a much closer coordination of range activities.

Limitation of the number of livestock to the carrying capacity of grazing lands, better distribution of grazing through the erection of fences, the development of watering places, proper seasonal use of the range, and better-planned salt distribution led to striking improvements in pasture and range vegetation. Adoption of a system of grazing, based on the growth requirements of desirable plants, also helped bring about a tremendous improvement in the quantity and quality of vegetation. The response, in most cases, far exceeded expectations.

Forage-requirement studies made in cooperation with other agencies led to a much better understanding of the carrying capacities of different range areas. The grazing of rotation crops was studied to determine what amount of grazing would still leave sufficient residues for turning under as green manure. In the Pacific Northwest it was found that sweetclover and grass seedings made in the spring would carry one-half of an animal unit per acre per month after the plants reached a height of about 12 inches, without decreasing the yield the second year or impairing the protection provided for the soil during the winter. Second-year sweetclover and grass, after it has reached a height of 10 to 12 inches, would carry two animal units per acre per month. The use of rotation crops in relieving range and pasture land stood out as an important factor in range and pasture improvement.

The Service was influential in developing a consciousness of range conservation among both stockmen and other agencies. Stress was placed on the need for better balance between range use and work for range improvement.

ENGINEERING

Although the Service began to place more emphasis on the use of vegetation to control erosion, mechanical structures continued to play an important part in the coordinated program of soil and water conservation. The use of such measures, however, was placed on a more practical and efficient basis as more information on their adaptabilities and limitations became available. Significant progress was made in coordinating mechanical with vegetative control measures. In turn, this led to a considerable reduction in initial costs as well as a lowering of subsequent maintenance costs. At the same time, the effectiveness of mechanical control structures was materially increased.

Detailed information regarding the adaptabilities and limitations of mechanical measures was obtained by field studies and observations. Results obtained from such investigations aided greatly in standardizing methods of installation. Detailed information regarding the use of specific measures, suitable for use by Service technicians in the field as well as by farmers generally, was being prepared in bulletin form. Two such bulletins entitled "Terracing for Soil and Water Conservation" and "The Nichols Terrace: An Improved Channel-Type Terrace for the Southeast," were published. Manuscripts for additional bulletins on drainageways and gully-control structures were under way.

RECORDS AND STATISTICS

The recording of cost data and statistics in conjunction with the application of mechanical measures was a basic factor in bringing about more efficient use of such measures. Cost figures not only revealed the cost of installing various types of structures but also brought about actual cost reductions by pointing out those methods and techniques which were most economical.

The effectiveness of the cost-records system was improved considerably by the addition of qualified technical men in each of the regions. With the aid of additional field supervision, new and simplified methods of recording, both cost and accomplishment records, were developed and standardized. A method of maintaining accomplishment records for soil conservation districts was also developed.

EQUIPMENT SPECIFICATIONS

Careful attention was given to analysis of the requirements of various jobs for which machinery was required to determine the specific types of equipment that would perform these jobs most economically. Approximately 200 specifications were prepared for use in connection with the procurement of major equipment. Cognizance was taken in the preparation of these specifications of improvements and developments in all types of farm and construction machinery, as well as the adaptability of the particular machines to the job. A careful

check of all equipment was made, from the technical standpoint, to insure compliance with performance and service requirements.

In addition, studies were begun to determine what needs, if any, existed for new types of machinery that would efficiently perform necessary farm operations, and at the same time permit erosion-control practices to be economically carried out. Investigations were also started to determine what types of machines would most efficiently perform the required operations in the desired manner.

HIGHWAY EROSION CONTROL

In cooperation with the Bureau of Public Roads and the highway departments of 32 States, the Service conducted an extensive program designed to demonstrate practical and economical methods for the control of erosion along highways and roads. Short stretches of rights-of-way, ranging from 1½ to 2½ miles in length, were selected as sites for experimental or demonstrational projects, and the work of installing erosion-control measures was carried on in cooperation with the interested agencies. A total of 96 projects, covering a distance of 155 miles, were under way at the close of the year. In addition, erosion-control measures were installed on more than 280 miles of State and county roads adjacent to farms under cooperative agreement with the Service. Work of this type was performed for the dual purpose of safeguarding the roads from damage caused by run-off from adjoining fields, and to protect fields from excessive accumulations of water in roadside ditches.

ADVANCES IN ENGINEERING TECHNIQUES

From a technical standpoint, one of the most significant engineering advances of the year was the preparation of water-disposal plans for entire farms, prior to the installation of mechanical structures. In the past, such structures as terraces or diversion ditches were often built without first making adequate provision for the disposal of water that accumulated in their channels. As a consequence, it was frequently necessary to provide elaborate and costly measures to safeguard outlets from erosion damage.

By preparing water-disposal plans in advance of construction, however, it was found that safe outlets could be provided in most cases by the much less expensive method of seeding or sodding natural waterways. In making such plans, surface-drainage features of the entire farm were taken into consideration and provisions made for future as well as immediate needs. A number of outstanding advantages resulted: There was closer coordination between the use of mechanical and vegetative-control measures, initial costs of installation as well as subsequent maintenance costs were reduced, and perhaps equally important, it enabled cooperating farmers to follow a systematic program of field operations from season to season and from year to year as the various vegetative-control measures were established.

Additional uses for vegetation in combination with mechanical measures were developed. One was the use of sod flumes to conduct water safely over and around overfalls. Another was the use of sodded earth fills on drainage areas up to 25 acres in size. These were inexpensively installed and consisted merely of a well-tamped earth fill, completely sodded on the downstream side and over the top. Structures of this type were used only in localities where the protection of a heavy scour-resistant sod could be maintained.

In some areas, particularly in western Kansas, it became necessary to rely wholly on mechanical structures for safe protection of drainageways, since the cost of maintaining many of the vegetative measures was found to exceed the cost of mechanical structures. Investigations seemed to indicate this would also be the case in other areas where rainfall is not uniform enough to maintain heavy turf throughout the year.

A new type of contour-furrowing machine was developed in Iowa, which successfully produces a furrow having an embankment of 6 to 8 inches in height, and does not destroy any existing sod. This machine worked successfully in the bluegrass areas and will probably be used more extensively in the future in regions where pasture sod and soil conditions are favorable.

In Puerto Rico, where extremely steep slopes are cultivated and bench terraces are necessary to protect the land against erosion, new methods of building the benches were developed. One of the most promising methods was the barrier system, in which a row or strip of close-growing grass is

planted at a point where a terrace is desired, after which the natural downhill movement of soil is allowed to build up the bench over a period of years.

In the Great Plains region the use of small dams for the creation of stock-watering ponds and reservoirs to provide supplemental irrigation became much more widespread. The technique involved in locating and constructing these dams was improved to such an extent that in many cases they were put into practical use in many locations formerly considered unsuitable.

Considerable progress was made in the development and use of the trickle spillway, a small paved channel in the lowest part of a vegetated channel, to carry small flows. This device effectively prevented silting and kept the turf from becoming water-logged.

Greater attention was given to maintenance of all types of structures, and particularly terraces. Terrace-maintenance demonstrations were held in practically all regions where terracing was common. The methods of maintaining terraces were improved to such an extent that adequate maintenance was provided, in most cases, by the regular farming practices, where carried on in proper manner.

WOODLAND MANAGEMENT

As in former years, activities of the Section of Woodland Management were divided along two principal lines: The planting of trees and shrubs on land best suited for that use, and the preservation of existing timberland on erodible lands through woodland-management practices.

Tree planting during the year brought the total number of trees and shrubs planted by the Service so far to approximately 350,000,000 on 220,000 acres. For the first time definite efforts were made to determine survival rates for all plantings. A survey of approximately half the acreage planted revealed that about one-third of the plantings had a satisfactory survival rate of 40 percent of living trees. On the remaining two-thirds, a survival rate of 78 percent was recorded.

In the Great Plains, it was found that tree-planting programs of the Forest Service and the Soil Conservation Service offered many points of similarity, but also a number of differences that were adjusted through a memorandum of understanding between the two agencies. As a result, the Department of Agriculture was able to present one forestry program to the landowners within the Prairie States forestry project of the Forest Service, regardless of whether work was actually carried out by the Soil Conservation Service or the Forest Service.

A new policy for the furnishing of trees and shrub-planting stock to landowners in soil conservation districts was established. Under this policy, the Soil Conservation Service will furnish to cooperating landowners, up to the limit of available supplies and in accordance with the farm plan for erosion control, the entire quantity of planting stock needed where it does not exceed 3,000 plants. The Service will provide 20 percent of the entire quantity where the need is in excess of 3,000. Up to 3,000 plants the stock will be supplied free. One-half the number of plants needed, in excess of 3,000, will be supplied free provided the landowner will secure the balance from other sources. In no case, however, will the Service furnish an individual with more than 25,000 plants.

This policy was designed to accomplish three things: (1) Insure at least a small demonstration of tree and shrub planting as an essential erosion-control measure; (2) stimulate the purchase of nursery-grown trees and shrubs from State and commercial nurseries; and (3) divide the burden of reforestation on eroded lands between the public and the landowner in recognition of the responsibilities of each.

Greater appreciation for woodland cover as protection for the soil was brought about by the demonstration of sound woodland-management practices. Cooperating farmers were encouraged to consider their woodland in much the same light as their cropland, and to follow better cutting and stand-improvement practices in order to increase woodland values from both a monetary and an erosion-control standpoint. Information on the part of woodland cover in the control of erosion was prepared for publication.

WILDLIFE MANAGEMENT

As the diverse erosion-control measures and practices entered their third and fourth years of use, it became more and more evident that soil conservation

measures can be of great benefit to wildlife. Accordingly, wildlife activities continued to emphasize the creation of wildlife habitats of a type compatible with conservative land use.

In many regions, wildlife technicians extended their cooperation with other agencies. Memoranda of understanding were developed with a number of State conservation commissions. In Iowa, for example, the State agreed to post the lands of Service cooperators and to continue a wildlife-management plan after the expiration of the Service-cooperator agreements. Assistance was given 4–H Clubs in soil conservation-wildlife work throughout the country. In Oklahoma, under a plan developed by Service biologists, 1,127 4–H Club members were enrolled in wildlife-conservation projects, with approximately 1,200 acres fenced and under wildlife-management plans. Requests for assistance in 4–H conservation camps increased to such an extent the Service had difficulty in filling them. Talks, lectures, and field demonstrations with colleges, civic clubs, sportsmen's organizations, and schools gave biologists an opportunity to explain the soil and water conservation program to groups that might otherwise have gained little first-hand information about it.

Rodent-control work necessary for the protection of conservation structures, together with other wildlife operations, were carried out on 99,868 acres. Close cooperation was maintained with the Bureau of Biological Survey. The further reduction in acreage treated, as compared with the previous year, was made possible in part through additional developments in rodent-resisting structures and practices.

The practice of protecting and planting fence rows increased considerably in all regions where it could be utilized. Increased use was made of buffer strips of woody vegetation, placed on the contour to intercept soil coming down slopes, and containing species of plants useful to wildlife. This was particularly true in the upper Mississippi Valley and the central Great Plains regions. In the northern Great Plains, further work was done on shrub buffer strips to prevent snow blowing and consequent loss of moisture for crops.

The building of wildlife habitats associated with bodies of water was successfully adapted to soil and water conservation. Beaver liberated in certain areas in the Northwest built dams that withstood heavy floods in the spring of 1938. Some of their ponds stored considerable water, while others acted effectively as silt catchment basins. Such ponds, of course, were built at extremely low cost. More attention was given to the control of eroding stream banks. Noteworthy achievements were recorded in this work in the Northwest and in the Lakes States, where vegetation planted to protect the banks was widely utilized by wildlife. The planting of vegetation on banks of ponds continued. Marsh plants that follow the shore line and protect it against wave action, rather than aquatic species which grow out to fill the ponds, were generally chosen. This semiaquatic vegetation was of a sort that provided food as well as cover for wildlife inhabiting wetter areas.

In the treatment of gullies and galled spots with vegetation of particular value to wildlife, continued analysis of the practice led to considerable reduction in cost. In the Southeast, costs were reduced considerably by premulching, that is, mulching the gully in the fall of the year and thereby eliminating more costly soil preparation prior to seeding the following spring. More judicious placing of plants in gullies permitted a reduction of almost 50 percent in planting costs in the same region. In the Northeast, gullies and raw banks were seeded directly to woody species as well as herbaceous species which acted as a nurse crop. The direct seeding method permitted the use of seed mixtures easily obtained, rather than nursery stock, which in most cases was difficult for the farmer to procure.

Before recommending uncertain practices, field trials were undertaken to determine the effectiveness of new practices. In the Southeast, trials to determine the effectiveness of seeding mixtures and the rates and time of seeding herbaceous plants for use in gully control were instituted. It was found that disking at certain times frequently produced volunteer native herbaceous plants of outstanding value for wildlife. Food-habit records of certain game species were accumulated for specific areas to insure erosion-control plantings that would include plants of greater palatability to wildlife. In all regions, field tests were made of repellents, which, when applied to seeds or young plants, may prevent rodent and rabbit damage and thereby save the time and money involved in replanting operations.

CONSERVATION NURSERIES

Nursery activities were curtailed and consolidated. Nineteen temporary nurseries were discontinued as a result of increased efficiency in the operation of larger and better-equipped units. At the close of the year, the total number of nurseries in active operation had been reduced to 36 in 28 States. Of these, 32 were engaged in the production of woody stock and grass seed, and in observational work: the other 4 were used exclusively for seed production and observational purposes.

As in the past, soil conservation nurseries were responsible for obtaining adequate planting materials for use in demonstration areas, through production of trees, shrubs, and grass plants; seed production and collection; or through direct purchase from commercial sources.

During the year nurseries furnished 124,200,597 woody plants for use on demonstration projects and C. C. C. camp areas, and 21,000,000 trees and shrubs to cooperating Federal and State agencies carrying on erosion-control activities. More than 141,973,777 plants were produced in Service nurseries, and 2,249,820 seedlings were secured under cooperative agreements with Federal and State nurseries. In addition to this nursery stock, which included only materials actually delivered for use in the erosion-control program, 82,120,681 plants were grown and carried over in the nurseries for future use. The work involved the propagation, growing and distribution of conifers, hardwoods, shrubs, and vines. Foremost among these were white, red, loblolly, shortleaf, and slash pines; juniper, black locust, Russian-olive, ash, hackberry, tulip poplar, cottonwoods, and willows. The shrubs were primarily wildlife species and included privet, barberry, wild plum, viburnum, Siberian pea, and dogwood.

The vines were mainly kudzu, with lesser quantities of wild grape, ampelopsis, and honeysuckle. With the improvement of nursery technique and the development and installation of needed nursery facilities, the nurseries were able to supply a higher grade of planting stock than in the past. As production reached a stage proportionate to the requirements of the using sections, more rigid grading standards were possible.

Table 6 itemizes the stock-production operations of the nurseries by regions, including plants obtained from other Federal, State, or commercial nurseries.

TABLE 6.—*Summary of nursery stock produced and purchased, 1938*

Region	Usable plants produced and purchased	Plants carried over	Region	Usable plants produced and purchased	Plants carried over
	Number	*Number*		*Number*	*Number*
1	20,217,805	32,297,967	7	9,651,417	2,492,545
2	46,728,174	4,298,676	8	2,620,000	380,000
3	26,441,875	8,714,776	9	3,452,471	3,253,850
4	5,860,000	1,238,000	10	905,301	114,867
5	27,868,100	22,900,000	11	755,454	3,430,000
6	700,000	3,000,000			
			Total	145,200,597	82,120,681

The tree and shrub seed furnished, both for use in the nurseries and direct project planting, represented a total of 1,150,941 pounds of seed collected or obtained from commercial sources on competitive bids. Of this total, 25,000 pounds of black locust seed were purchased from farmer growers. Conifer seeds were collected in greatest quantity, consisting mostly of loblolly, shortleaf, and slash pines, red cedar and Rocky Mountain juniper. Hardwood tree seeds included mainly walnuts, oak, hickory, ash, tulip poplar, and hackberry. The following is a summary of tree and shrub seed collected and purchased, by regions, for 1938:

Region:	*Pounds*	Region:	*Pounds*
1	528,610	8	45,600
2	81,892	9	33,300
3	118,398	10	4,440
4	23,462	11	63,600
5	158,910		
6	8,000	Total	1,150,941
7	84,729		

Definite improvements were made in the methods and machinery used in the collection of seed of native grasses. As a result, unit costs were reduced and the harvesting of certain species, previously considered unobtainable, was undertaken. Certain native seed-producing areas possess natural advantages that make the collection of large quantities of seed a relatively simple operation, and consideration was given to the feasibility of supplying the native grass seed needs of some regions by obtaining and transferring seed from production areas where the seed could be most readily and economically obtained.

The nurseries directed operations involving the collection of 427,157 pounds of native grass seed. The principal species collected were bluegrass, little bluestem, dropseed, wild-rye, needlegrass, tobosa, switchgrass, and buffalo grass.

Large quantities of field-crop and grass seed were also obtained through purchase from commercial sources and farmer growers, as shown in the following tabulation:

Kind of seed:	*Pounds*	Kind of seed:	*Pounds*
Oats	443,600	Bluegrass (Canada and Kentucky)	27,029
Lespedezas (annual)	248,770	Fescue	18,580
Lespedezas (perennial)	152,650	Oatgrass	16,971
Clovers	204,713	Cowpeas	12,360
Austrian Winter peas	177,470	Feterita	11,600
Western wheatgrass	120,585	Bulbous bluegrass	9,225
Bromegrass	75,002	Soybeans	6,700
Vetch	74,326	Carpet grass	5,450
Sorghum	70,580	Reed canary grass	5,000
Dallis grass	52,070	Milo	3,500
Orchard grass	48,279	Kudzu	3,967
Slender and crested wheatgrass	47,804	Johnson grass	1,500
Alfalfa	44,709	Bermuda grass	1,405
Sudan grass	42,155	Wheat	1,300
Barley	41,121	Quincy grass	1,000
Redtop	33,772	Black medic	950
Ryegrass	33,042	Rescue grass	800
Rye	31,688	Miscellaneous (species)	9,891
Timothy	30,112		
Crotalaria	27,265	Total	2,136,941

In addition to securing and utilizing field-crop and grass seed in erosion-control activities, 15,902,000 grass plants, principally Holland grass, were grown and distributed by the nurseries for use by the planting agencies of the Service.

Considerable progress was made in charting the approximate boundaries of the range or habitat of most of the more valuable species of plants in use by the Service. This work was of inestimable value in facilitating the collection and utilization of those types of plants best adapted to the control of erosion in areas where revegetation was necessary. Considerable information of this nature was compiled and prepared for publication.

Since the Section of Conservation Nurseries has as its primary function the provision of adequate quantities of planting materials for erosion-control operations, constant efforts were made to improve the species in common use and to introduce new plants better suited to perform effective and economical erosion control. This was accomplished in part by the study and selection of seed trees and seed sources to insure that only seed of superior individuals would be used for the production of nursery stocks and for direct project plantings. Numerous examples of this work could be cited, such as efforts to bring true shipmast locust into quantity production as a substitute for the common black locust. This variety indicates borer resistance, greater rapidity of growth, and apparently will produce a more marketable product. A number of other plants received similar attention, particularly hackberry, honeylocust and ash, and certain oaks and conifers.

A significant activity of the Section of Conservation Nurseries was the assembly, observation, and testing of superior plants and methods for erosion-control purposes. Through cooperation with the Section of Hill Culture Research of the Division of Research, this type of work became increasingly important in most of the nurseries. Plants were studied and tested from the standpoints of human food, forage value, and economic products, in addition to their erosion-control value. Efforts were also made to determine their ability to survive and propagate under problem-area conditions.

Plant exploratory work conducted cooperatively with the Division of Plant Exploration and Introduction of the Bureau of Plant Industry, in 1935, introduced numerous grasses and legumes from the Union of Soviet Socialist Repub-

lics, Turkey, and other Mediterranean regions. Several thousand of these species were planted in nurseries in Texas, Arizona, California, throughout the Great Plains, and in the Pacific Northwest. Much of this material had gone through the observational and testing stages and was, in several instances, used in the erosion-control planting program for the first time this past year.

The assembly of native plant materials such as grasses and legumes, the introduction of exotics, and the study of plants that have economic as well as erosion-control value were conducted cooperatively with the Bureau of Plant Industry, other bureaus of the Department, and, in a number of instances, with State agricultural experiment stations. This work resulted in many additions to the improved plant species available for use in the erosion-control program.

RESEARCH

Research activities of the Service were brought into closer coordination with the operations program through evaluation surveys conducted jointly by the Divisions of Research and Operations.

Although these surveys produced a rough measure of the effectiveness of operations work, they also brought out many debatable points that will need to be clarified by more extended studies at the field research stations of the Service. Consequently, it seemed desirable to expand the activities of many field stations and to make them administratively responsible to the entire Division of Research rather than to the different research sections, as formerly. By the close of the year, a number of stations were in the process of administrative transformation along these lines.

Under the new plan of organization, it is believed that the six sections of the Division of Research, by using the combined facilities available at these stations may bring a more effective attack to bear on the problems of soil and water conservation. It is also believed that this attack will thus be made more responsive to the new and increasingly complex problems that are to be met in every section of the country and that State agricultural experiment stations will find it more satisfactory to develop cooperative work with the Division as a whole rather than with six separate sections.

As in the past, research findings of the Service were made available to the Division of Operations, as well as to State experiment stations and extension workers. Through the latter groups, soil conservation research data were transmitted both to individual farmers and to cooperative organizations, such as the soil conservation districts.

EXPERIMENT STATIONS

Experimental work was initiated on two of the six new sites that have been under development as soil and water conservation experiment stations for the past 2 years. In addition, the work previously carried on as a general unit in Arizona and New Mexico was divided into two separate projects. Thus, by the close of the year, 16 experiment stations were engaged in developing and testing the principles, measures, and practices considered essential in the conservation of the Nation's soil and water resources. Development work on the remaining four new experiment station sites was rapidly nearing completion and experimental studies were expected to be initiated at several of them during the coming year.

Many of the experimental studies produced further evidence that close-growing perennial vegetation will conserve soil and prevent excessive run-off. A comparison of the effectiveness of dense protective cover and cultivated row crops is shown in table 7. It may be noted that in nearly all cases erosion would take thousands of years to remove the topsoil from land protected by grass cover, while it would require only a few decades to remove the same amount of topsoil from land in clean cultivation.

Studies were initiated to determine the specific effects of different plant covers on run-off and erosion. The results obtained so far show that crop plants intercept a considerable quantity of the rainfall and prevent it from reaching the ground. During one season at Bethany, Mo., alfalfa intercepted 35.8 percent of the rain that fell during the growing season, as compared with a 15.5- and a 6.9-percent interception for corn and oats, respectively. These results indicated the comparative value of different types of crops in intercepting rainfall, but other factors equally or more important in the erosion process also needed investigation.

TABLE 7.—*Soil and water losses under cultivation and protective cover, from 13 important soils representative of the principal types of erodible farm land within an area of approximately 250,000,000 acres*

Soil type, location, and years of measurement	Annual rainfall for period	Slope	Clean-tilled			Dense cover			Time to remove 7 inches of soil		Approximate regional area [1]
			Crop	Annual soil loss per acre	Water loss as percentage of annual precipitation	Cover	Annual soil loss per acre	Water loss as percentage of annual precipitation	Clean tilled	Dense cover	
	Inches	*Percent*		*Tons*	*Percent*		*Tons*	*Percent*	*Years*	*Years*	*Million acres*
Cecil sandy clay loam, Statesville, N. C., 1932–36	48.42	10.0	Cotton	25.08	10.47	Mixed grasses	0.014	0.29	46	82,150	41
Nacogdoches fine sandy loam, Tyler, Tex., 1932–36	42.34	10.0	do	8.18	16.48	Bermuda grass	.006	.53	160	214,200	48
Kirvin fine sandy loam, Tyler, Tex., 1932–36	41.77	8.75	do	30.07	22.23	do	.05	.91	46	27,400	
Shelby silt loam, Bethany, Mo., 1931–35	34.79	8.0	Corn	68.78	28.31	Alfalfa	.25	7.49	16	4,540	18
Muskingum silt loam, Zanesville, Ohio, 1934–36	36.46	12.0	do	72.23	41.95	Bluegrass	.04	6.5	16	28,900	31
Clinton silt loam, La Crosse, Wis., 1933–35	34.12	16.0	do	88.66	20.84	do	.03	2.82	11	33,600	22
Dubuque silt loam, La Crosse, Wis., 1934–35	36.53	30.0	do	81.44	19.12	do	.22	6.83	11	4,110	
Vernon fine sandy loam, Guthrie, Okla., 1930–35	33.12	7.7	Cotton	24.29	14.22	Bermuda grass	.032	1.23	50	38,200	37
Houston Black clay, Temple, Tex.:											
1931–36	32.76	4.0	Corn	23.83	14.22	do	.03	.04	34	26,700	8
1933–36	34.90	2.0	do	10.62	13.38	do	.10	.95	75	8,010	
Marshall silt loam, Clarinda, Iowa, 1933–35	26.82	9.0	do	18.82	8.64	Bluegrass	.06	.97	48	15,200	23
Palouse silt loam, Pullman, Wash., 1932–35	21.74	30.0	Wheat, fallow	8.52	9.40	Mixed grasses	1.45	3.71	130	740	8
	21.74	30.0	Bare	27.82	25.03	Spring wheat	1.65	3.23	38	650	
Colby silty clay loam, Hays, Kans., 1930–35	20.36	5.0	Kafir	11.74	16.20	Native grass	.029	.30	91	36,900	10
Miles clay loam, Spur, Tex., 1926–37	20.73	2.0	Cotton	7.03	15.53	Buffalo grass	1.29	4.34	150	830	

[1] Figures represent approximate acreage of soil types in the region specified.

An analysis of the data for comparable storms from the experiment stations at Bethany, Mo., and Clarinda, Iowa, revealed that dense vegetation, in practically all cases, greatly reduced the rate at which water ran off the fields. Furthermore, even in those few instances when the total quantity of run-off was the same, the water from fields with dense vegetation moved at slower velocities and carried off considerably smaller quantities of soil.

Equipment for measuring the rate of run-off from small plots was developed and installed at several of the experiment stations for thorough testing under field conditions. Preliminary results indicated that this equipment was functioning satisfactorily under a wide range of conditions and would aid materially in determination of the basic factors influencing erosion.

In the arid and semiarid regions, studies of the effectiveness of water spreading in water conservation were made. Run-off water, which would otherwise have been lost, was diverted from areas of high concentration to areas of low concentration by means of diversion dikes or ridges and put to productive use in developing vegetative cover. However, in certain cases, because of the high concentration of silt or soluble salts, this water retarded the growth of vegetation. A study was eventually developed to determine the factors affecting the most profitable use of such diverted water.

Studies on the problem of wind erosion were limited to the development of methods for reclaiming and stabilizing one particular area near Dalhart, Tex., which was severely damaged by drifting sand dunes. By the close of the year, however, plans were under way for inaugurating a series of investigations near Amarillo, Tex., on the fundamental causes of soil drifting.

Two parties worked in the field almost continuously to determine the infiltration rate of water into important soil types in various parts of the country. In these studies one party made use of an artificial rainfall applicator. These parties worked not only on the experiment station grounds but also on adjacent areas, so that results obtained at the stations could be extrapolated to those soils not represented on the station property. These studies revealed that one of the most important factors influencing the intake of water by the soil was the soil structure. Studies were conducted both in the field and in the laboratory to determine the factors affecting soil structure and the methods necessary for its modification. Organic-matter content was found to be highly important. Experiments were started at virtually all the experiment stations to determine practical methods of increasing the content of organic matter in the soil and to determine its effect in reducing soil and water losses.

Preliminary results of laboratory studies indicated that the material removed from the soil by erosion contained a higher percentage of organic matter than the original soil in the field. In other words, the portion of the soil most rapidly destroyed by erosion is also the most valuable portion from the standpoint of erosion resistance and plant-growth stimulation. This undoubtedly accounted, in part at least, for the progressively accelerating rate of erosion and showed the necessity of developing cultural practices to protect the soil from erosion as well as to maintain or increase its organic content and fertility.

Many of the experiments at the older experiment stations have now been conducted long enough to yield the major portion of the information that may be obtained from the type of experiments originally set up. Consequently, plans were developed in consultation with the cooperating State experiment stations, for revising or eliminating those experiments that have served their purpose and for initiating new experiments to furnish information necessary to carry forward the soil conservation program.

WATERSHED AND HYDROLOGIC STUDIES

Construction work was nearly completed and many observational data were collected on the two large experimental watershed projects previously established. One of these is located in the north Appalachian area near Coshocton, Ohio, and the other in the Texas blackland area near Waco, Tex. A third large experimental watershed project was established in the central Great Plains area near Hastings, Nebr.

In addition to the work on these experimental watershed projects, the Section of Watershed and Hydrologic Studies made rapid progress in the selection, construction, and instrumentation of 85 watershed run-off studies conducted in cooperation with the Division of Conservation Operations. Activities of the Section were expanded by the initiation of simulated rainfall studies and by the assignment to the Section of Hydraulic Laboratory Investigations previously

under way at the National Bureau of Standards and at the Service's outdoor laboratory near Spartanburg, S. C. The Section continued technical supervision of hydrologic studies of the Service conducted on a number of demonstration areas in cooperation with the United States Geological Survey and State agricultural experiment stations. It also supervised for the Service certain recent Works Progress Administration activities concerned with research in hydrologic data being used in the flood-control investigations of the Department.

EXPERIMENTAL WATERSHEDS

The first objective of the studies conducted on the large experimental watersheds is to determine quantitatively the effect of improved land use and erosion-control practices on soil and water conservation for the agricultural regions represented. The second is to find the extent to which improved land use and erosion-control practices can be effective in the control and reduction of floods as well as in sustaining and augmenting stream flow during periods of dry weather.

In order to attain these objectives more effectively the experimental watersheds in Ohio and Texas, which cover about 5,000 acres each, were subdivided into smaller watersheds of different sizes. On each of these smaller watersheds, various land use and erosion-control practices were applied after determination of size, slope, soils, and other physical characteristics of the areas. Precipitation, stream flow, ground-water levels, soil losses, crop yields, and many other factors were included in the observational procedure.

Status of the construction and operation of various observation stations on the three experimental watersheds at the beginning and end of the year is shown in table 8. In addition to observation station construction, the principal buildings on both the Ohio and Texas projects were completed near the close of the year. Attention was given to the development of adequate water supplies, the construction of sewage-disposal facilities, and other necessary service connections. Several miles of roads and trails were improved for all-weather use on the three watersheds, and progress was made on other construction items directly and indirectly concerned with operation of the projects.

TABLE 8.—*Number of observation stations on the north Appalachian, Texas blackland, and central Great Plains experimental watersheds, June 30, 1938*

Station	North Appalachian, near Coshocton, Ohio			Texas blackland, near Waco, Tex.			Central Great Plains, near Hastings, Nebr.		
	In operation		Under construction June 30, 1938	In operation		Under construction June 30, 1938	In operation		Under construction June 30, 1938
	June 30, 1937	June 30, 1938		June 30, 1937	June 30, 1938		June 30, 1937	June 30, 1938	
Precipitation stations, recording	13	25	-------	13	22	-------	-------	5	-------
Precipitation stations, nonrecording	76	76	-------	99	90	-------	-------	12	-------
Run-off stations, flumes	2	9	3	2	9	7	-------	-------	-------
Run-off stations, current meter [1]	11	[2] 15	[3] 3	2	6	-------	-------	-------	3
Silt sampling stations, automatic [4]	2	7	2	-------	7	1	-------	-------	-------
Silt sampling stations, manual [5]	11	14	2	4	8	6	-------	-------	3
Ground-water wells, recording	30	36	-------	2	15	-------	-------	-------	-------
Ground-water wells, manual [6]	5	-------	-------	110	152	-------	-------	-------	-------
Lysimeters [7]	3	3	6	-------	-------	-------	-------	-------	-------
Temperature stations, air	3	3	-------	8	8	-------	-------	-------	-------
Temperature stations, soil [8]	3	3	-------	3	3	-------	-------	-------	1
Central meteorological station	-------	1	-------	-------	-------	1	-------	-------	-------

[1] Artificial controls rated by current meter measurements.
[2] 3 stations in cooperation with Muskingum Watershed Conservancy District.
[3] 2 stations in cooperation with Muskingum Watershed Conservancy District.
[4] Ramser silt samplers.
[5] Point samples taken in the cross section.
[6] Observations made at 3- or 4-day intervals.
[7] 1 of the Coshocton lysimeters is equipped with recording weighing device.
[8] 3-pen soil thermographs.

An important development in Ohio was the expansion of flood studies being carried on in cooperation with the Muskingum Watershed Conservancy District. As shown in table 8, two gaging stations were completed and put in operation

and the construction work on three other stations was under way at the close of the year.

During the fall and winter months, progress was made in making surveys and selecting gaging-station sites on the Hastings, Nebr., experimental watershed. Since the beginning of construction in April, work has gone forward at three main stream-gaging stations and in the installation of rain gages.

Many observation stations were in operation during all or part of the year. Extensive basic computations and tabulations were made with the data collected at these stations as well as from infiltration experiments, soil-moisture determinations, and other studies for which observation points or stations are localized but not fixed. Considerable progress was made in calibrating instruments, rating stream-flow-measuring stations, adjusting recorders, making basic and periodic surveys, and especially in developing observational procedures and laboratory methods.

A number of scientific papers were written and presented to technical societies and several manuscripts were prepared for both technical and nontechnical publications. For the most part, these papers and manuscripts described various plans of the Section's research program. Some dealt with design and construction of the dual Parshall flumes, the weighing lysimeter, and other installations and equipment with unusual features. Others were prepared as tentative or progress reports on particular phases of the investigations, such as the relative "catch" of standard and recording rain gages under various exposures, and the possible existence of ground-water mounds in the same ground-water horizon. Sufficient data were not as yet available, however, to support conclusions to the basic objectives of the experimental watershed studies.

WATERSHED RUN-OFF STUDIES ON OPERATIONS PROJECTS

In cooperation with the Division of Operations, the Section continued to establish run-off studies on demonstration project areas. These studies are intended to supplement, eventually, the more detailed work conducted on experimental watersheds. They have important immediate value, however, in the design of hydraulic structures used by the Division of Operations and by cooperating farm organizations.

Work was done on 85 watersheds located in 20 demonstration projects in 10 regions. The number of watershed studies in each project, the locations of the projects, and the status of gaging-station construction and operation are shown in table 9.

Considerable progress was made in the development of procedures and methods for rapid analysis of the collected data.

TABLE 9.—*Number of watershed run-off studies on operations projects, June 30, 1938*

Region	Location of project	Watersheds	Watershed gaging stations and appurtenances			
			Completed and in operation	Complete except for instruments	Under construction	Preliminary work done
1	Bath, N. Y.	4	4			
	Freehold, N. J.	4	4			
	Hagerstown, Md.	4	2		1	1
2	Americus, Ga.	4		4		
	Danville, Va.	3		2	1	
3	Hamilton, Ohio	4	2	1	1	
4	Garland, Tex.	6			3	3
	Bentonville, Ark.	6				6
5	Edwardsville, Ill.	4	4			
	Fennimore, Wis.	4	2		2	
6	Vega, Tex.	3	3			
	Colorado Springs, Colo.	4	4			
7	Muskogee, Okla.	4			2	2
8	Albuquerque, N. Mex.	6			2	4
	Mexican Springs, N. Mex.	4				4
10	Safford, Ariz.	6		2	4	
	Santa Paula, Calif.	5	2	3		
	Watsonville, Calif.	4		1	1	2
11	Emmett, Idaho	2				2
	Newberg, Oreg.	4		3	1	
Total		85	27	16	18	24

SIMULATED RAINFALL INVESTIGATIONS

In connection with the other work of the Section, particularly in the central Great Plains, an important activity was the initiation of simulated rainfall investigations.

Progress was made in the further development and use of a portable sprinkler apparatus, whereby artificial rainfall in various amounts and intensities was played upon plots in order to study the relationships of rainfall, run-off, and erosion under controlled conditions. More than 70 tests were made in eastern Nebraska on plots with various soils, slopes, vegetal covers, and cultivation practices.

At the close of the year, the apparatus itself and methods for its use were still in an experimental stage of development. Much work remained to be done in relating the data obtained to watershed areas under natural rainfall conditions. It was believed, however, that these investigations would eventually produce information now seriously needed. Data on the responses of various land types to probable maximum intensities of rainfall are virtually essential in the land use phases of flood-control surveys, and this is especially true of the Great Plains region, where rains are frequently heavy.

HYDRAULIC LABORATORY INVESTIGATIONS

Soil conservation hydraulics, instrumentation studies, and mechanics of erosion embrace the activities assigned to the Section during the latter part of the year. The program was initiated, however, in 1934 and through expansion from time to time developed the following principal objectives: (1) To increase the dependability and decrease the cost of the hydraulic works used in soil and water conservation, and (2) to develop technical equipment for use in soil and water conservation research.

Studies in soil conservation hydraulics were carried out principally at the outdoor hydraulic laboratory near Spartanburg, S. C. Valuable information was derived from tests of channels protected with the various types of vegetation frequently used in meadow strips and grassed waterways. These tests revealed the relative protection afforded by Sudan grass, *Lespedeza sericea*, and common lespedeza. In addition, they yielded data on the hydraulic characteristics of waterways lined with such vegetation. The results of some of these tests are summarized in table 10 to show the remarkable protection against scour afforded by vegetal channel linings and the profound effect of vegetation on the hydraulic characteristics of channels. Additional information of considerable practical value was obtained by tests of the discharge capacities of notches, check dams, and similar structures.

TABLE 10.—*Summary of results of tests of vegetal linings in small channels*[1] *at the Spartanburg Outdoor Hydraulic Laboratory*

Kind of channel lining	Value of Kutter's *n*	Probable safe velocity[2]	Kind of channel lining	Value of Kutter's *n*	Probable safe velocity[2]
	Coefficient of roughness	*Feet per second*		*Coefficient of roughness*	*Feet per second*
Bermuda grass—solid sod	0.035	8	Sudan grass	0.033	5
Lespedeza sericea	.038	3	Bare[3]	.018	1
Common lespedeza	.037	4			

[1] Bermuda grass channel had bottom width of 1 foot and side slopes of 1 on 1. All other channels had bottom width of 2 feet and side slopes of 1 on 3. Maximum test flows somewhat exceeded 15 cubic feet per second.

[2] For good cover and short periods of run-off with recovery periods intervening.

[3] Test of bare channel made to provide basis for evaluation of the effectiveness of the vegetal linings. The soil in the bare channel was the same as that in the 3 channels lined with lespedeza and Sudan grass.

Most of the instrumentation studies were made at the National Bureau of Standards. These studies included the development of a flume of improved design for more precise run-off measurement, the design of improved divisors, the design and testing of several types of artificial rainfall devices, the testing of various types of water-stage recorders and recording rain gages, and the development of precise weighing devices for special research uses.

Investigations and model tests completed by this Section last year at the National Bureau of Standards' laboratory, resulted in the preliminary design of a broad-crested weir type of gaging-station control which was used for watershed run-off studies. Further tests of this type of control on a larger scale were begun in April 1938 at the Cornell University hydraulic laboratory, Ithaca, N. Y. These tests, conducted with a weir one-half the actual size, resulted in a refinement of the design that effected savings in the construction costs without sacrificing efficiency of the control. At the end of the year, this work was being continued in an attempt to develop ratings in the laboratory for various types of installation conditions that frequently cause difficulty when rating is done in the field by current meter measurements.

Little more than preliminary work was done in the studies on the mechanics of erosion. Progress was made, however, in the development of special equipment and in the improvement of experimental technique for measuring sizes of raindrops and their velocity. The pronounced effect of size and velocity of drops on erosion was clearly shown by the many observations taken in connection with the development of artificial rainfall devices.

COOPERATIVE STUDIES WITH UNITED STATES GEOLOGICAL SURVEY

The cooperative studies of the Service with the Geological Survey and the State agricultural experiment stations on several Soil Conservation Service demonstration areas were continued by the Division of Operations under the technical supervision of the Section of Watershed and Hydrologic Studies. Data on precipitation, stream flow, silt movement, and ground-water fluctuations were collected on watersheds at Mankato, Kans., Shenandoah, Iowa, Bethany, Mo., High Point, N. C., Stillwater, Okla., Spartanburg, S. C., Temple, Tex., Pullman, Wash., and La Crosse, Wis.

As a continuation of work initiated the previous year, analyses were made of the hydrologic data previously collected, together with information on the physical characteristics of the watersheds and changes in land use practices. Preliminary reports of these analyses formed the basis for recommending changes in the collection of data on the projects at Shenandoah, La Crosse, Pullman, and High Point, and for recommending termination of the studies on the other projects, since they were found to be yielding insufficient data to justify their continuation.

RESEARCH IN HYDROLOGIC DATA

With the expansion of Service activities in connection with cooperative soil conservation district work, and the flood-control investigations and surveys assigned to the Department under the Omnibus Flood Control Act of June 1936, there have arisen more pressing needs for research in hydrologic data and related information. To aid in meeting these needs, the W. P. A. inaugurated a suitable work project, one part of which was assigned to the Section of Watershed and Hydrologic Studies for technical supervision and immediate direction. From its inception in April 1938 this project grew until it included a total of 42 workers engaged in collecting meteorological and other types of hydrologic data from many sources, putting them into convenient form, and bringing them as nearly up to date as practicable. The hydrologic data collected were tabulated, computed, plotted, and summarized, thus making possible more rapid assembly and use of valuable information.

GEOGRAPHIC AND CLIMATIC STUDIES

Integrated research in the fields of climate, physiography, and erosion history was continued in order to amplify and supplement controlled experimentation in soil conservation. By supplying an historical background of farmer experience with erosion and by determining regional geologic and climatic factors, this coordinated and simultaneous research was designed to aid in extrapolating the results obtained at soil conservation experiment stations. In the end, it was expected to make possible the accurate delimitation of regions within which similar erosion-control measures may be effective.

CLIMATIC STUDIES

The climatic research station established in western Oklahoma in 1935 was discontinued at the beginning of the fiscal year. The results obtained at this

station, however, paved the way for the establishment of a similar but considerably larger climatic research station in Ohio as a State W. P. A. project, conducted in cooperation with the Muskingum Watershed Conservancy District. In this project, covering the 8,000 square miles of the Muskingum Valley, 500 self-recording rain gages, and an equal number of instruments for measuring temperature, relative humidity, wind velocity, and wind direction were installed at intervals of approximately 4 miles. Maps showing the distribution of surface temperature for each hour of the day were made, commencing June 1, 1937. Precipitation maps showing the distribution and intensity of rain for half-hour intervals were made for the period beginning July 1, of the same year. On each continuously rainy day, 48 of these maps were made. It required 667 maps to represent the rainfall for the month of July, and 2,258 maps for the period from July 1 to November 1, 1937. Maps were also made for relative humidity, wind velocity and direction, and cloudiness for each hour.

Noteworthy progress was made in the development of improved, inexpensive instruments. Accurate self-recording rain gages and hygrothermographs were developed and are now maufactured at costs of approximately 25 and 35 percent, respectively, of the previous prices. Similarly, a new anemometer and wind vane were designed and manufactured at only a fraction of the cost of any satisfactory previous instruments. An accessory to the recording rain gage was developed to give on the rain-gage chart a continuous record of wind velocity and wind direction, as well as precipitation. An evaporation pan giving a continuous record of evaporation was the most recent development at the Ohio project, where a sample instrument was placed on test.

The climatic data recorded in Ohio have so far proved to be of special value because the Geological Survey and the Muskingum Watershed Conservancy District are making stream-gage measurements on a large number of the intermediate and smaller tributaries in the Muskingum Valley. The unparalleled rainfall record obtained through operation of the close network of self-recording rain gages and the determination of run-off from the several watersheds of the valley has permitted a study of the relation between rainfall and run-off on an entirely new basis.

In order to sample more effectively the large general storms extending beyond the limits of the Ohio climatic-project area, maps were prepared for 6-hour periods showing all available climatic data from the airway stations located in the northeastern quarter of the United States. Additional data were secured from more than 100 self-recording rain gages installed in Pennsylvania and portions of adjacent States by the Weather Bureau in cooperation with State agencies.

It is believed that this study of rainfall-run-off relations will help make possible the determination of the effect of land use on floods, which is one of the primary research objectives of the Department at the present time. The climatic information being obtained makes it possible to treat each rainstorm as an individual event, and permits isolation of the various influences that produce variations in the rainfall-run-off relationships.

The first bulletin prepared by the clamatic unit, entitled "Sources of Moisture for Precipitation in the United States" (U. S. Dept. Agr. Tech. Bull. No. 589), demonstrated the intimate relation between modern air-mass meteorology and hydrology. It presented a revised concept of the hydrologic cycle, indicating that the Maritime air masses moving in from the sea are the ones that bring moisture to the land, and that the Polar Continental air masses rob the continents of moisture and transport it back to the ocean.

Immediate practical value was attached to the statistical research which the Section conducted on precipitation intensity-frequency. It has been recognized that the methods in common use for determining rainfall intensity-frequency are inadequate for use by engineers in designing soil conservation and flood-control structures. The present spacing of meteorological stations has made it impossible to record all the intense storms that cover small areas and has caused the too frequent sample of lower-intensity storms covering large areas. A method recently developed by the Section for revising storm frequencies obtained by the station-year method calls for determining on a statistical basis the amount of correlation between rainfall stations for storms of specified size. From these data, the number of valid station-years in the record was ascertained. The method, which is simply an application of the statistical technique used for testing persistency in observations taken at equal time intervals, was employed for the first time in the analysis of rainfall records.

During the fiscal year 1937, an analysis was made of the rainfall records of Lynchburg, Va., Elkins, W. Va., and Washington, D. C., to determine the relation between maximum rate, duration, and storm amounts in terms of rainstorm morphology. During the year the analysis was extended to several western stations and the results applied to erosion and flood problems. This formed the basis of a manuscript that was prepared and submitted to the Department for publication.

PHYSIOGRAPHIC RESEARCH

One of the major problems in developing the program of physiographic research was caused by the fact that observational work of the type employed was unfamiliar to agricultural research workers. For this reason the physiographic unit's first publication, What is Soil Erosion? (U. S. Dept. Agr. Misc. Pub. No. 286), examined erosion from the standpoint of the geologist or physiographer, and showed the relation of what is popularly called geologic erosion to soil erosion. With the aid of 101 illustrations, the publication described the various physiographic processes involved in soil wastage, and indicated in nontechnical language some of the regional variations in these processes as well as the climatic and geologic basis for such variations.

Since physiographers and geologists have given relatively little attention in the past to soil erosion, research projects were set up to study a variety of physiographic processes in widely contrasting regions. From the study of one region, a manuscript entitled "Soil Erosion in the Limestone Lands of Western Kentucky" was prepared. This manuscript, which discussed the peculiarities of soil erosion in a region with subterranean drainage, was more or less applicable to the 5 million acres of agricultural land in the United States that have this peculiar type of drainage and cannot always be successfully treated for erosion control by ordinary methods. The manuscript was submitted to the Department for publication.

A second technical study, dealing with principles of gully formation in the Piedmont is entitled "Principles of Gully Erosion in the Piedmont of South Carolina" (U. S. Dept. Agr. Tech. Bull. No. 633). Because of the deep weathering of the bedrock in the southern Piedmont, gullies have cut rapidly to great size and have presented a difficult problem in erosion control. The bulletin demonstrated the relation of the deep, caving gullies to specific rock and soil types, and land use practices. The principal elements in the process of gully formation were found to be dependent on rainstorm types, and the annual cycle in these processes was found to be controlled by seasonal changes in the climatic forces. These were shown to be the basic data on which erosion-control techniques particularly adapted to the Piedmont must be planned. Further physiographic study in the Piedmont, on the relation of rock type, soil-slope profile, and drainage pattern to the character and distribution of gullies, was carried forward to isolate, in terms of these factors, the areas of excessive gully hazard.

Field studies were initiated to determine the agricultural significance of mass movements of soil, such as soil creep, earth flow, and slumping. These studies indicated that the natural erosion in humid lands was not only less in amount, but also different in type, from the present culturally induced erosion. Under natural conditions, where the soil surface was almost completely covered with vegetation and with the organic products of plant life, gullying was practically nonexistent and sheet wash was so slow as not to interfere with soil-forming processes. Thus, it seemed probable that most of the denudation occurring under these conditions was due to mass movement.

Before the field work was started, an examination was made of existing literature on mass movement. A comprehensive bibliography was prepared and made available in manuscript form for consultation. A survey was undertaken for purposes of delimiting areas in which mass movement is particularly prevalent and determining the nature and agricultural implications of the processes. Because of the comprehensive and detailed rainfall records available for the Muskingum watershed, the first intensive field studies in mass movement were started in this section of Ohio.

EROSION HISTORY

Examination of Oklahoma documents and writings both before and after the turn of the twentieth century led to publication of Erosion and Its Control in Oklahoma Territory (U. S. Dept. Agr. Misc. Pub. No. 301). This study was of

particular interest because it showed the amount of damage that could be caused by erosion in the short span of 30 years. It also brought out the fact that some progressive farmers in Oklahoma had developed effective methods of erosion control even before 1900.

A study of erosion in Virginia, completed and published the previous year under the title "Early Erosion-Control Practices in Virginia" (U. S. Dept. Agr. Misc. Pub. No. 256), was extended to include the entire southern Piedmont. This extension seemed advisable in view of the erosion hazards peculiar to the Piedmont environment and to its one-crop system of farming.

Erosion-history investigations were also initiated in Ohio as part of a unified program of research conducted cooperatively with the Ohio Agricultural Experiment Station in the Muskingum drainage basin. Analysis of rainfall data by the Ohio climatic project suggested a new approach to the study of physiographic processes in the Muskingum Valley. Erosion-history research in the drainage area supplied a basis for evaluating the relationship between land utilization and the damage caused by erosion and floods. The program as a whole was designed to provide a background for the development of an effective program of soil conservation and flood control.

These studies in Oklahoma, the southern Piedmont, and Ohio were only part of a concerted effort that was undertaken to assemble all available information on the erosion history of more extensive areas within the country. Erosion-history-research projects were established by the W. P. A. in Massachusetts, Pennsylvania, Maryland, Virginia, North Carolina, South Carolina, Ohio, Indiana, Kentucky, and Wisconsin. Each project consisted of 1 trained supervisor, acting under the technical direction of the erosion history unit, and 20 or more relief workers. A uniform system was developed for examining early records and transcribing verbatim those items dealing with erosion and floods, control measures employed, and the related land use practices. The information collected was sent to Washington where it was analyzed and filed as source material for future publications. The location of these projects was determined on the basis of their value to the unified research program of an entire geographical section.

Research studies in the erosion history of the ancient world and in contemporary experiences with erosion in foreign countries were continued. These studies were being embodied in two papers which should give perspective to present erosion-control activity in the United States.

SEDIMENTATION STUDIES

The work of the Section of Sedimentation Studies was brought into close coordination with the flood-control activities of the Department, carried out under authority of the Omnibus Flood Control Act of 1936 and subsequent amendments. During the fall months five members of the technical staff of this Section were detailed to the Section of Flood Control Surveys to assist in preliminary watershed examinations, with particular reference to the effects of sedimentation in reducing the effectiveness of flood-control reservoirs and impairing the capacity of channels and valley floodways for carrying flood flows. Reconnaissance examinations of sedimentation were made in 35 major drainage basins and reports were submitted for inclusion in preliminary examination reports of the Department.

An extensive series of surveys was made in the Los Angeles, Calif., area following the flood of March 2, 1938. Examinations were made of sediment accumulation and damage on fan and flood-plain areas in the five southern California counties of Ventura, Los Angeles, San Bernardino, Riverside, and Orange. The surveys consisted of mapping all deposits laid down outside of channel and reservoir areas by depth and type of deposit and by type of land affected. A preliminary tabulation of results from these surveys showed that more than 88,000 acres were covered by deposits of some type and that about 42 million cubic yards of sediment were laid down. Fine sand predominated over every other type of material deposited by a ratio of more than 4 to 1. It comprised some 28 million cubic yards of the total as compared with nearly 7 million cubic yards of coarse sand and nearly 6 million cubic yards of silt, the next most abundant types. Nearly a million cubic yards of boulders and about 350,000 cubic yards of gravel were also measured. Final results of this survey are expected to shed considerable light on the character of fan building in the western intermontane valleys.

RESERVOIR-SILTING INVESTIGATIONS

During the fall and winter months three reservoir-silting surveys were carried forward in the vicinity of the District of Columbia. These investigations were made on the recreation lake in the Greenbelt development of the Farm Security Administration in Prince Georges County, Md.; on Burnt Mills Reservoir, water supply for the Washington Suburban Sanitary District, near Silver Spring, Md.; and on Barcroft Reservoir, municipal water supply for Alexandria, Va.

Early in March field parties were organized to continue the program of reservoir-silting investigations in various sections of the country. A field party in the Eastern States completed a resurvey of the municipal reservoir at High Point, N. C., which was first surveyed by the Soil Conservation Service in 1934. This party also made initial surveys of municipal reservoirs at Lancaster, S. C., Monroe, N. C., Burlington, N. C., and Franklinton, N. C., the last two located in Soil Conservation Service demonstration-project areas. It was expected that the resurvey of High Point Reservoir would be particularly valuable in affording a basis for correlating reservoir-silting rates with suspended-load studies conducted on major tributaries above the reservoir. These studies have been carried forward in cooperation with the Geological Survey continuously since the previous reservoir survey of 1934.

A second field party in the Midwest completed surveys of municipal reservoirs at Wills Point, Tex., Grand Saline, Tex., Clinton, Okla., and on Ardmore Club Lake at Ardmore, Okla.

A third survey party was organized in California for investigations of reservoir silting resulting from the flood of March 2, 1938. Resurveys were made of Santa Anita and Live Oak Reservoirs, previously surveyed in 1935, and of Devils Gate Reservoir, previously surveyed by the Los Angeles County Flood Control District. Enormous rates of silting were indicated by these surveys, although computations of the exact amount of fill were not completed by the end of the year. In most cases, the amount of erosional debris deposited by this one flood was at least equal to sediment accumulated in the reservoir during its entire previous life; and in some cases the flood deposits exceeded previous accumulations by a wide margin.

Technical direction, through the assignment of a party chief, was given to surveys of four flood-control reservoirs in the Muskingum Valley in Ohio, and of Kenwood Reservoir on Cherry Creek, near Denver, Colo. These surveys were made for the purpose of establishing precise ranges to be used in future sedimentation studies.

STREAM- AND VALLEY-SILTING INVESTIGATIONS

Work on stream- and valley-silting investigations was concentrated mainly on the preparation of a report covering the relation of this type of sedimentation to culturally accelerated soil erosion. The report was based chiefly on the results of studies in the Tallahatchie drainage basin of northern Mississippi, where the Sardis Reservoir is now being constructed for flood control. All information gained from investigations in other areas, however, was utilized to make the report more nearly complete. Some 350 sediment samples were subjected to mechanical analysis in connection with the Tallahatchie work, and the results will be included in the report.

Further progress was made in the compilation of data for a report on stream and valley sedimentation in the middle Rio Grande Valley of New Mexico. In the summer of 1937, the system of valley cross sections was extended to cover the entire middle valley at average intervals of about 3 miles, making a total of 47 complete valley cross sections. In the upper third of the middle valley, the only basis of comparison is a set of topographic maps made in 1918 by the State engineer, which, although not so satisfactory for the purpose as might be desired, appear to show that even this upper part of the valley is subject to measurable aggradation. In connection with these Rio Grande investigations, about 40 representative channel samples were collected from the main stream and its principal tributaries for laboratory investigation. As the year closed, heavy mineral counts were being made on these samples to determine whether this method will provide a basis for quantitative evaluation of the relative importance of various sources of sediment in contributing to the aggradation.

In July 1937, an investigation and survey of silting was made in the Anacostia River between Bladensburg Bridge and the Pennsylvania Railroad bridge, a distance of 11,700 feet, within the District of Columbia.

Brief reconnaissance examinations were also made of valley sedimentation conditions in parts of Illinois, Iowa, Wisconsin, and Minnesota, and plans were made to initiate more detailed studies in that general region in the near future.

Late in the year a study was started in cooperation with the New Hampshire Agricultural Experiment Station on sources of sediment causing damage by overwash to agricultural lands in the Merrimack Valley.

BED-LOAD INVESTIGATIONS

Construction of channel control and appurtenant features for measuring the movement of sediment along stream bottoms was completed at the three stations located on Rocky River, near Statesville, N. C.; South Sandy Creek, near Dadeville, Ala.; and Enoree River, near Greenville, S. C. During preliminary experiments at the Enoree station, however, work at the Rocky River and Sandy Creek installations was temporarily suspended. These preliminary experiments were designed primarily to calibrate the bed-load intakes and to formulate a definite plan for routine operation of the installations.

At the Enoree station, progress was made on the construction of a discharge rating curve, topographic mapping of the Enoree channel floodway to the headwaters for future flood-routing and drainage-area correlation studies, establishment of a number of selected valley cross sections for measurement of valley aggradation, and the construction of a cableway on a natural stream section above the installation for the simultaneous observation of velocity and sediment distribution under natural conditions. To supplement the river observations, a concrete flume 5 feet wide, 30 inches deep, 50 feet long, and provided with a sand feed and a sand trap, was installed at the Enoree station for studying the behavior of typical Piedmont sands under definite controlled hydraulic conditions.

In cooperation with the field projects for reservoir silting and stream- and valley-silting investigations, a sediment-analysis laboratory was in the process of construction at the Enoree station. Facilities were being provided for the mechanical analysis of coarse material by sieving, and of fine material by the hydrometer and pipette methods.

HYDRAULIC LABORATORY INVESTIGATIONS

The work of the hydraulic laboratory established in cooperation with the California Institute of Technology to carry on fundamental research on the mechanics of sediment-laden flows was continued along the lines described in the annual report for 1937. In the study of the mechanics of transportation of suspended load, calibration runs of the flume made necessary miscellaneous revisions in the apparatus. At the same time, instruments for measuring velocities and for sampling the suspended load were developed, constructed, and calibrated.

A preliminary set of experiments, carried out in a turbulence jar, on the effect of sediment characteristics on suspended load was concluded. This permitted study of the effect of the physical characteristics of a sediment upon its distribution in the vertical column of the fluid. The results obtained are in substantial agreement with the theory of turbulent suspension advanced by O'Brien and Von Karman. A report of this research was prepared and plans were made to present it at the next meeting of the International Congress for Applied Mechanics.

Sufficient experimental data were obtained in the research on density currents in reservoirs to give some indication of the controlling factors in this very important phenomenon. Many of the data were recorded by motion pictures for future study.

Research on the development of sampling technique and methods for making and interpreting mechanical analyses resulted in the publication of two papers by George H. Otto, The Use of Statistical Analysis in Effecting Improvements on a Jones-Type Sample Splitter, and The Use of Sedimentation Unit in Field Sampling.

Additional experimental work along various lines resulted in the submission of a design for a sediment separator for use on the bed-load project, the development of an improved single-unit Eakin silt sampler, and the design for a multiple-unit sampler of this type. Progress was also made in the development of a high-velocity flowmeter, and work was completed on the construction of jars for making correlative wear studies. The flume for the study of wear of debris was also completed.

In connection with field studies on erosion-control structures for the Division of Operations, hydraulic models of an overfall-type soil-saving dam and of a chute-type soil-saving dam were tested at the laboratory. These tests resulted in a modification and simplification of the designs originally submitted. Additional progress was made on the construction and installation of a model suitable for more comprehensive basic tests of soil-saving dams of the contracted overfall type. As a result of the field observations of arroyos and a study of their control, the preparation of a discussion of the mechanics of arroyo formation and the development of a plan for their reclamation was undertaken in cooperation with the engineering staff of the Service.

ECONOMICS OF SOIL CONSERVATION

Research in the economics of soil conservation, conducted cooperatively with the Bureau of Agricultural Economics and the State agricultural experiment stations, was carried forward in 18 States and initiated as new work in 1 State.

The principal objective of these studies remained unchanged. Economic research workers continued to direct their efforts mainly toward a determination of the economic feasibility of a soil and water conservation program from the standpoint of the individual farmer. The work was broadened, however, to include consideration of the economic and social feasibility of soil and water conservation programs from the point of view of the public interest.

In each of the several erosion-control demonstration areas under study, economic research workers sketched a cross-section picture of the agricultural systems being followed at the time the recommended soil and water conservation program was adopted. These workers also gathered information on the historical background of each area and on the influences that affected the prevailing systems of land use. Current records of progress under the soil conservation program were correlated with all this material to serve as a basis for the measurement of changes. Although conclusions of a definitive nature were not obtainable from studies so recently initiated, some idea of the probable economic and social effect of a definitely planned soil and water conservation program may be derived from studies conducted in the Crooked Creek demonstration area, in Indiana and Armstrong Counties, Pa.

These studies, which were published in mimeographed form by Pennsylvania State College, "The Economic and Social Implications of the Crop and Livestock Adjustments in the Crooked Creek Erosion Control Project, Indiana and Armstrong Counties, Pennsylvania," showed that considerable progress had been made in the Crooked Creek project over a 2-year period toward the eventual goal of the soil conservation program without materially upsetting the economic order for the area as a whole. Cropping systems had been altered without involving any drastic change in land use or farming practices. It was found, however, that on some farms, which had previously been operated under conditions highly conducive to erosion, the new program did call for rather far-reaching changes in crop production, and as a result, in kinds and numbers of livestock. On many of these farms, the changes meant a decided increase in cash and other outlays, and indicated the definite possibility of decreased incomes during the transition period. These farms could accept the major changes called for in the soil and water conservation program only with difficulty. While considerable doubt exists as to how long they could have operated under the old soil-depleting system, the problem of maintaining income was a major consideration from an immediate point of view under the new systems. Further study should serve to clarify this aspect of the program.

A number of other manuscripts in the same vein were prepared to be submitted for publication through the respective agricultural experiment stations at some time during the coming year.

A somewhat more limited type of soil conservation economic research is exemplified in the studies of strip cropping that were undertaken in Ohio, Pennsylvania, and West Virginia. These studies were reported in mimeographed releases, A Preliminary Report of a Study of Strip Cropping in Belmont County, Ohio; Strip Cropping in Southwestern Pennsylvania, Preliminary Report; and Strip Cropping in Northern West Virginia, by the respective States and revealed a number of interesting facts relative to the early efforts of farmers to initiate the practice of strip cropping on their farms. Apparently many present-day farmers learned of it from the predecessors; others, like the predecessors, apparently developed the practice as the result of a definite need

under local conditions of soil and slope. As might be expected under such conditions, no apparent uniformity prevailed in the use of strip cropping as a practice. This can be attributed in some cases to its spontaneous origin, in other cases to the varying conditions under which it developed, and in still others to the length of the developmental period.

Preliminary reports of the farm-business-analysis type, depicting the agriculture found in an area, together with its income possibilities, were prepared in Minnesota, Illinois, Ohio, and other States.

More formal publications, descriptive of the agriculture of an area and its income possibilities, were represented by a Virginia Station bulletin, An Economic Study of Farming in Appomattox County, Virginia (Virginia Station Bulletin 311), in which the author pointed out the several factors contributing to the success of farmers in the area. It was found that soil erosion had contributed to declining yields, shifts in production, and lowered income.

A study made at Clovis, N. Mex., in cooperation with the Division of Operations, was embodied in a mimeographed release, Preliminary Report, Economic Survey, Clovis Project Area, New Mexico No. 9. In this release the agriculture of the area was described, its pressing problems discussed, and the economic relationships to be considered were outlined.

A similar study made at Kutztown, Pa., was prepared in manuscript form but not submitted for formal publication. This study also revealed descriptive and analytical information that should help in the more effective planning of soil-conserving programs in line with the best utilization of the farmer's resources, taking due account of his material limitations and the economic setting both on his farm and in the broader environment where he operates.

Attention was given to the sociological factors associated with soil erosion. Study of a decadent area in North Carolina produced valuable information on the changes in ownership of farm land, the occupational stability of farm workers, their mobility, their housing, and other living conditions. Final summarization of these data should prove helpful in understanding the effects of soil erosion and fertility depletion on family life, rural living standards, farm depopulation, and rural poverty. A similar study was initiated in Oklahoma.

Further research of public rather than individual import was centered in an effort to determine the economic consequences of silting in municipal water-supply reservoirs of the Southeast. These studies were conducted in cooperation with the Section of Sedimentation Studies and with the North Carolina Agricultural Experiment Station. Preliminary evidence indicated that erosional debris from farm lands is damaging Piedmont reservoirs in two ways. In addition to shortening the useful life of the reservoirs through storage depletion, this debris, because of its high content of finer sediments and colloidal materials, is increasing annual operating costs for purification and clarification of the water.

HILL CULTURE RESEARCH

Hill culture studies continued to aim at the application of ecologically sound soil-conserving principles in managing the production of standard crops and at finding or developing and managing for economic soil conservation new or little-used plants of superior erosion-control possibilities.

Research work along these lines, conducted in conjunction with the Bureau of Plant Industry, was established in cooperation with the agricultural experiment stations of Alabama, California, Iowa, Maryland, and Ohio. Each of these projects represented a distinct plant-growth region where the work was urgently needed. This cooperative activity varied somewhat with the different conditions in the States, but in each case noteworthy progress was made in the assembly of plant materials, in establishing plantations, and in conducting detailed studies on the treatment of sloping land on experimental tracts, along lines aimed at conserving water and building up and retaining the soil under use. The work advanced most rapidly at the Alabama and Iowa Stations, where a number of plantings were made of plants especially promising for growth on hill lands, both as crops and as erosion-control vegetation.

Research at the State experiment stations on the hill culture problem was supplemented by work at the Agricultural Research Center, Beltsville, Md., where a 1,700 acre-tract was made available by the Department. The activities of the Service at the Beltsville station were carried forward in cooperation with the Maryland Agricultural Experiment Station, and with the Bureau of Plant Industry through its Plant Introduction Station at Glenn Dale, Md. The coop-

eration was carried out jointly by the sections of Hill Culture Research and Conservation Nurseries under a closely coordinated plan.

Progress was made in the development of new and more practical methods for propagating desirable erosion-control planting stock through direct rooting of hardwood cuttings of certain species. These findings are of considerable economic importance to soil and water conservation programs since they furnish practical reproduction methods for the improvement of planting stock. For example, it is now possible to reproduce the shipmast locust by hardwood cuttings at low cost, whereas formerly this valuable farm tree was not used in the Service planting program because the supply of stock was limited and the tree could be produced only by root cuttings or sprouts at a cost that was prohibitive.

EVALUATION SURVEYS AND FIELD TESTS

Observational, evaluation, and field-testing activities carried on cooperatively by the Divisions of Operations and Research with the assistance of the agricultural experiment stations, served to focus attention on the value of such work in relation to program improvement, training of personnel, and the development of plans for all conservation activities. The application of evaluation schedules to certain erosion-control practices already in operation was made in a number of demonstration projects.

Seventy-two work plans were prepared and approved for carrying on evaluation studies in connection with strip cropping, terracing, range and pasture management, tree and shrub planting, gully control, contour farming, water spreading, winter cover cropping, and various other practices.

Development of this work on a regional basis avoided the unnecessary duplication of studies between States and regions and made possible better coordination of all activities in this field.

Studies contributing directly to the demonstration program may be divided into three classes. The first consists of field observations by Service technicians on the general effectiveness of various erosion-control measures. The second involves the detailed case study of a representative number of sample farms on which some one erosion-control practice had been adopted. The third type of study consists of systematic field tests designed to supply more definite information than was possible under either of the other methods.

As the evaluation studies and field tests progressed, they revealed problems that called for more extended research. These problems were referred to the research stations or to the State experiment stations for more extended trial and intensive work. The results of the evaluation surveys and field tests were used not only in improving the demonstration program but were passed on to extension workers, vocational agriculture teachers, and interested farm organizations.

LIBRARY

Increased use was made of the Service library by both the Washington and the field staff. The circulation during the year was 4,983 books and 1,846 periodicals. Field offices received on a loan basis a total of 189 items. The majority of requests from the field for reference articles occurring in current publications were met by supplying photostatic copies. In this way, unbroken journal files were maintained in Washington. A total of 329 different photostats were supplied, 225 going to various field offices, and the remainder being used by Washington employees. The accessions to the library amounted to 1,740 items, including 461 books, 931 continuations of journals, 303 pamphlets, and 45 maps.

The mimeographed bimonthly publication, Soil Conservation Literature; Selected Current References, appeared regularly. Its mailing list was steadily enlarged to meet requests from workers in Government agencies, libraries, and private organizations.

Toward the close of the year, the library committee recommended that an effort be made to develop regional branch libraries in regional offices in order to facilitate library service for project technicians.

PUERTO RICO AND THE VIRGIN ISLANDS

Research work in Puerto Rico was directed toward the development of methods for stabilizing soil under the peculiar agricultural conditions prevailing on the Island, where the density of population virtually forces the cultivation of land that sometimes slopes as much as 80 percent.

Initial experiments carried out at Mayaguez in cooperation with the Federal experiment station showed the possibility of building practically flat bench terraces where the sloping banks were stabilized by close-growing grass or cover plants. At first, a considerable amount of hand labor, together with draft animals, was used in this work. During the past year, however, attention was concentrated on less expensive methods of building these bench terraces by planting stiff-stemmed, upright-growing plants such as elephant grass on the contour, at a vertical distance of some 4 to 5 feet between terraces. The terraces were gradually developed by plowing the soil along the contour at each period of cultivation. A portion of the soil was lodged against the vegetative barrier and a relatively level bench or terrace was gradully formed by accumulations of silt. Studies carried out during the year indicated that these terraces will be effective in controlling erosion, and that they can be built at a relatively moderate cost.

Experimental work carried out at Mayaguez produced results that were applicable on the demonstration projects conducted in the western section of the island. A similar group of experiments was started in cooperation with the Insular Agricultural Experiment Station at Rio Piedras, which is representative of the eastern portion of Puerto Rico. The experimental work carried out at both these sites provided excellent ground work for all soil conservation demonstration work on the island.

The operations program in Puerto Rico was expanded from one area adjacent to the Mayaguez station to four additional areas. At Cayey, in the south-central part of the Island, near the center of the principal tobacco-producing section, work was centered on stabilizing the soil and on producing tobacco in contour plantings. At Adjuntas, where the agricultural lands are principally devoted to growing coffee, demonstrations were inaugurated to stimulate the adoption of contour planting and contour cultivation by the coffee farmers. At Rio Piedras, demonstration work was carried forward on lands of small farmers who produce a variety of truck crops for local sale. At Luquillo, the demonstrations were located on homesteads formerly planted to sugarcane.

In all four demonstration projects the work was carried on in cooperation with the Puerto Rico Reconstruction Administration and was closely related to that agency's program of resettlement and rehabilitation of Puerto Rican farmers.

The soil conservation program has been developed as a closely integrated whole in which research and field work have been intimately associated. At the outset, little was known about erosion-control methods which could be employed in tropical agriculture. It was necessary, therefore, to conduct constant study and experimentation in order to find procedures adapted to the island conditions.

Toward the close of the year, a conference was held between the Service representatives in Puerto Rico and the Governor of the Virgin Islands. As a result of this meeting, plans were developed for a soil and water conservation survey of St. Croix, St. Thomas, and St. John of the Virgin Islands. This survey was expected to point out the extent and seriousness of the erosion problem in this portion of the Tropics. Definite conclusions were not possible at the close of the year, but preliminary field work indicated a number of areas in several of the islands where dams could be located to impound water that could be used later for watering livestock, as well as for irrigation.

WATERSHED AND CONSERVATION SURVEYS

Survey activities broadened in scope and importance. Cooperation with soil conservation districts involved a major expansion of survey work. The Omnibus Flood Control Act of 1936, and subsequent amendments to it, placed new responsibilities on the Department in the field of land use planning. These responsibilities, in turn, necessitate comprehensive surveys of a majority of the watersheds of the country, with specific reference to the place of land in flood control.

As one of the agencies of the Department sharing the responsibilities assigned by the Flood Control Act, the Service began studying the possibilities of retarding water run-off for the specific purpose of reducing flood peaks. This work, of course, was a valid corollary to the basic program for conservation of soil resources through increased infiltration of rainfall into the soil and prevention of erosion.

To correlate these survey activities and develop an effective, unified, survey program, a new Division of Watershed and Conservation Surveys was established. In it were included three closely coordinated sections, Conservation Surveys, Flood Control Surveys, and Cartography, each headed by a technician qualified to direct that particular phase of work.

Representatives of the Division served on various departmental and interdepartmental committees, where considerable progress was made in the development of a unified survey program for the Department. This activity brought increased efficiency and eliminated duplications that existed in certain phases of the work. As an example, the conservation survey program of the Service and the soil survey program of the Bureau of Chemistry and Soils were interwoven into a coordinated program, so that in specified areas surveyed by each, the completed work would be uniform with respect to the recording and interpretation of important physical land factors necessary for basic land use planning.

The past fiscal year was the first in which funds specifically allocated for flood-control work were available in the Department. The Chief of the Division, as a member of the department flood-control committee, assisted in developing the plans of the Department for the coordinated interbureau preliminary flood-control investigations conducted during the year, and also in preparing the detailed survey and operations program to be initiated in the future.

CONSERVATION SURVEYS

Field survey offices were abolished on August 1, 1937, and field surveyors were transferred to the regions in which they were working. The object of this decentralization was to bring the surveys into closer relationship with the regional organization and with the entire field program. It also permitted better correlation with the programs of other agencies. Transfers and details of survey personnel between regions were made as the needs developed.

A comprehensive plan for soil and erosion surveys in the Department, involving the Soil Conservation Service, was developed during the year. This plan utilizes fully the inspectors of both the Service and the Bureau of Chemistry and Soils in the correlation of soil and erosion surveys. Inspection districts were outlined and inspectors assigned to each. A committee on soil and erosion surveys, consisting of representatives from the Land Use Coordinator's Office and from the two Bureaus, was named. Before any new surveys are undertaken, a preliminary working plan is prepared by the agencies cooperating on the survey and approved by the committee. The committee also correlates the factors mapped after a survey is completed, and makes recommendations for publication.

Detailed conservation surveys were made on 9,434 square miles of watersheds or county areas, located in 24 States. Field work was completed on 12 of these surveys and is still in progress on 27 others, ranging in size from 30 to more than 5,000 square miles. In addition, detailed surveys were begun on 22 soil conservation districts, and 1,053 square miles were mapped. By utilizing mobile survey personnel and equipment surveys of soil conservation districts could be started immediately after cooperation between the Department and the district was approved. Surveys on demonstration projects and C. C. C. areas were continued, with the mapping of approximately 5,220 square miles. Nine projects were completed, which, together with the 109 previously completed, made a total of 118. Reconnaissance surveys were begun in Washington, Oregon, Colorado, and California, and 8,205 square miles were mapped.

The erosion-reconnaissance work completed during the year supplemented the reconnaissance of 1934–35 and provided the most accurate appraisal of erosion conditions in the United States. Estimates based primarily on reconnaissance data were presented in summary form to show approximate erosion conditions as follows:

	Acres
Total land area (exclusive of large urban territory)	1,903,000,000
Erosion conditions not defined (such as deserts, scablands, and large western mountain areas)	144,000,000
Total land area (exclusive of mountains, mesas, and badlands):	
Ruined or severely damaged	282,000,000
Moderately damaged	775,000,000
Cropland (cropland harvested, crop failure, and cropland idle or fallow):	
Ruined for cultivation	50,000,000
Severely damaged	50,000,000
One-half to all topsoil gone	100,000,000
Erosion process beginning	100,000,000

Staff conferences were held to discuss the improvements in surveying methods. Revision of the conservation survey handbook was undertaken late in 1937 at a meeting of inspectors and regional soil scientists in Chicago. The revised handbook provides for the formulation of specific recommendations for land use, based solely on physical factors of soil type, slope, and erosion, but the farm plans developed from these recommendations are modified according to pertinent economic and social factors. The Service continued to base all soil conservation recommendations and plans on a physical land inventory, wherein these three factors are mapped in relation to present land use. In the spring of 1938 four conferences of field surveyors were held at Spartanburg, S. C., Oklahoma City, Okla., Salt Lake City, Utah, and Ithaca, N. Y.

A method of reproducing soil conservation survey maps by the multilith process was put into operation.

Nine reports on conservation surveys were prepared for publication and sent to the printer. Lithographed maps were prepared to accompany three of these bulletins, and multilith maps are to be supplied with the remaining six. Each bulletin included a description of the physical features and agriculture of the area surveyed, a summary of the results of the conservation survey, and a discussion of the significance of physical factors in the control of soil erosion.

FLOOD-CONTROL SURVEYS

With funds provided in the War Department Civil Appropriations Act of 1937, the Service cooperated in the completion of preliminary examination reports for run-off and water-flow retardation and soil erosion prevention on 32 watersheds. Preliminary examinations were undertaken on approximately 50 other drainage basins.

Inasmuch as these activities were the first of their kind undertaken by the Department, it was necessary to devote considerable time to the development of new procedures and techniques and to the coordination of the flood-control program with other action programs of the Department.

From the limited number of examinations made and the reports received, it became evident that treatment of the land to supplement trunk stream control is necessary on most watersheds if a permanent solution to the flood problem and a maximum utilization of soil and water resources are to be achieved.

CARTOGRAPHY

The Cartographic Section was reorganized for better efficiency into three units, map control, map compilation, and reproduction.

The map control unit had from four to six parties in the field most of the year making surveys for the control on aerial photographs. The area of conservation surveys thus controlled was 7,700 square miles and required 1,217 miles of third-order traverse. Standard brass station markers were placed at 3-mile intervals along this traverse. The field work made possible the location of numerous points on the aerial photographs and determined their location geographically.

Geodetic and plane coordinate computations were completed in nine areas, and map projections on transverse Mercator, Lambert, and polyconic projections constructed for seven areas. The cooperative project with the Geological Survey and the American Society of Photogrammetry, initiated in 1937, to determine the degree of accuracy obtainable through the use of radial triangulation using the slotted-templet method, and the results upon this accuracy through reduction of the number of ground control stations, were completed. The field work for this test was conducted at the Agricultural Research Center at Beltsville, Md. A system of determination of areas by weighing instead of by planimetry was developed, and the project of determining, by this method, the volume of Lake Mead for every 10-foot rise of the surface of the lake was started.

A detailed survey was made of the area allocated to the Section of Hill Culture at the Agricultural Research Center. Survey of another area, for the hydrologic section, was started at Coshocton, Ohio.

The map library, started a few years ago, proved valuable to staff members in Washington and in the field. It was also used extensively by other agencies. At the present time the library has on file about 23,000 different maps.

The map compilation unit was engaged in the preparation of aerial photographs for use in map compilation and for field use by the Section of Conservation Surveys. It also handled the compilation, by photogrammetric methods, of planimetric base maps; the assembly of conservation survey data on these maps; the final drafting of the planimetric base maps and the assembled conservation survey data for multilith reproduction; the assembly of reconnaissance conservation survey information on base maps compiled from existing data for lithographic reproduction; and various types of drafting work.

For office use drainage and culture were delineated on aerial photographs covering an area of 16,056 square miles. For field use drainage was delineated on photographs covering an area of 15,721 square miles. Planimetric base maps of 3,831 square miles were completed at a scale of 4 inches equal 1 mile, and conservation survey data on areas totaling 1,347 square miles was assembled. The planimetering of conservation survey data on 22,763 square miles was completed.

Drafting was completed on 2,661 square miles of planimetric base maps, 995 square miles of detail conservation survey maps, 21,483 square miles of reconnaissance base maps, and 14,686 square miles of reconnaissance conservation survey maps.

Draftsmen prepared 984 maps of erosion conditions, control practices, topography, land acquisition, and sedimentation surveys; 194 drawings of various engineering structures, architectural designs, and mechanical devices. They plotted 720 profiles, cross sections, graphs, and charts, and prepared 165 illustrations for publication. They colored 634 maps, posters, and charts, and 669 transparencies, photographs, and lantern slides. They mapped 118 photograph lay-outs, and mounted 429 maps and aerial photographs.

The reproduction unit provided technical supervision for aerial surveys covering approximately 9,400 square miles and photogrammetric surveys covering approximately 11,100 square miles. Materials were delivered, under contracts awarded prior to the past fiscal year, covering an area of approximately 104,000 square miles. These included photogrammetric surveys and radial-control mosaics of 44,600 square miles. The photogrammetric survey of Puerto Rico, for the Puerto Rico Reconstruction Administration, was completed. Specifications were being prepared for aerial surveys covering approximately 5,000 square miles in Washington and Oregon.

Because other agencies of the Department were also conducting aerial survey work, it was possible to borrow aerial photographic negatives covering a large percentage of the areas on which soil conservation work was to be initiated. In order to make the desired photographic reproductions the aerial surveys laboratory was enlarged. For some work it was necessary to design and build new equipment. During the year 24,200 contact prints, 19,600 enlargements, and 950 photographic index maps were made. Reproductions of approximately 69,100 square feet of blue line prints, and 46,100 square feet of photostats were made, in connection with map and chart work for various sections of the Service.

It was determined that large-scale conservation survey maps on small sheets would be valuable to the Service and to cooperating farmers. Accordingly such maps, drawn at a scale of 4 inches to 1 mile, were completed. Each covers an area of approximately 10 square miles. It was found that maps of this type could be reproduced on a large-size multilith machine, and toward the close of the year they were being reproduced in four colors; with the erosion, slope, and related soils data in brown, present land use in green, drainage in blue, and culture in black. A fifth color showed recommended land use.

ADMINISTRATION

To facilitate the conduct of personnel, training, and business-management activities and to coordinate related administrative functions, the former Divisions of Business Management and Personnel and Training were consolidated to form a new Division of Administration. As a result of this reorganization, considerable progress was made in perfecting administrative procedures throughout the Service, and marked improvement was apparent with respect to compliance with fiscal and procurement regulations.

Special emphasis was placed on audit reviews of all administrative field work, and an augmented auditing staff was developed, both in Washington and in the field, to make a complete audit of all existing records. Study of these reports resulted in the development of improved procedures to correct faulty administrative practices discovered in the audits.

Frequent field trips by members of the Division staff, and a number of conferences with regional administrative officers, contributed greatly toward the establishment of more uniform and improved business procedures.

FISCAL

The 11 regional fiscal offices operated on a decentralized basis, maintaining allotment accounts, performing audit of vouchers, and conducting related fiscal matters under the control and supervision of the Washington fiscal office. Disbursements were made through field Treasury disbursing officers and Army finance officers.

Close cooperation was maintained with the Department's Office of Budget and Finance, in order that fiscal policies of the Department should be followed.

A simplified system of accounting was devised for use of project offices. This system was placed in operation at the beginning of the year and was effective in maintaining accurate information at the projects on the current status of funds allotted to them, and in providing a simple method of reconciliation with the allotment ledgers maintained in the regional fiscal offices.

PROCUREMENT

Careful consideration was given to specific phases of procurement work and related activities in an endeavor to prepare regional offices for the broader authority and responsibilities resulting from decentralization. Virtually all authority that can be extended under the departmental regulations has been delegated to field offices. This applies to the certificates necessary in the purchase of foreign-produced articles, purchases from schedule contracts, and the approval of property-survey reports to the extent permitted by the departmental regulations.

Changes in actual field-operating conditions necessitated a study of the procedure for adequately covering changes in cooperative agreements. A revised procedure was developed in cooperation with technical divisions, and utilized in the field.

Regional supply centers were established to facilitate and economize the handling of administrative supplies. While these supply centers were not completely perfected, advantages were realized and regional stocks reduced. The accumulation of stock in one central point eliminated surplus in the regions and permitted better utilization of the funds available for this purpose.

Accident-claims work increased 25 percent and is attributed to the general expansion of the Service program. At the same time, greater coordination in the handling of automotive accident cases between the Washington, regional, and project offices was effected.

Four nursery sites, formerly held under lease, were acquired. Several building sites were also acquired, in various sections of the country, to be used chiefly as nursery construction sites.

The filing of patents by employees of the Service increased 40 percent over the last fiscal year. A majority of the devices were found to be practicable and of use in the conservation program.

PERSONNEL AND TRAINING

Personnel and training activities were directed toward the development of more intimate working relationships with the field offices as well as with the division offices in Washington. A careful study was made of the flow of personnel actions and several new procedures were instituted to speed up this part of the work.

Several regions were visited by classification investigators, and a consistent effort was made to review all positions throughout the Service in the light of present conditions.

The change in the Emergency Conservation Work Act, effective July 1, 1937, affected a considerable portion of the personnel since it removed positions in the C. C. C. from civil service status. The incumbents of these positions have been considered wherever possible in connection with vacancies occurring in the classified service and many of them were transferred to classified civil service positions.

TRAINING

Training activities were continued and in addition to the regular program, several of the regional offices held special seminars for employees in the lower grades in order that they might have a working knowledge of all activities of the Service. These seminars were followed by group visits to projects and camps so that soil conservation practices could be studied in actual operation.

A training program for vocational agriculture teachers was initiated in connection with the newly established conservancy districts in Regions 2 and 4.

SAFETY

A concerted program to inculcate safety consciousness in the minds of all employees of the Service was continued. Success of this program is evident from a comparison of the accident frequency for the first quarter of 1937 with the first quarter of 1938. This comparison shows a reduction in the accident frequency of 29.4 percent for the Service and 33.8 percent for the C. C. C. The reduction may be attributed to job and foreman training, the activities of field safety committees, field safety inspections, and the continued elimination of physical and job hazards.

SUMMARY

A summary of the personnel employed as of June 30, 1938, including permanent, temporary, letter of authority, and W. P. A. employees, follows:

	Number
Soil Conservation Service:	
Washington	929
Field	19,566
Total	20,495
Civilian Conservation Corps:	
Washington	96
Field	4,890
Total	4,986
Grand total	25,481

Washington salaries for Soil Conservation Service were $1,628,312, and field salaries and wages totaled $18,318,209.

The funds available for the year were as follows:

Regular appropriation	$24,390,780.00
Emergency relief appropriations	2,582,038.00
Civilian Conservation Corps	11,649,000.00
War Department, flood control	205,000.00
Miscellaneous appropriations and funds	299,078.00
Total	39,125,896.00

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REPORT OF THE SOLICITOR, 1938

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SOLICITOR,
Washington, D. C., September 20, 1938.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith the report of the work of the Office of the Solicitor for the fiscal year ended June 30, 1938.

Respectfully yours,

MASTIN G. WHITE, *Solicitor.*

CONTENTS

	Page
Divisional changes in the office	1
General summary of work	2
Health and Quarantine Division	3
Foods and Drug Act	3
The New Federal Food, Drug, and Cosmetic Act	6
Federal Caustic Poison Act	6
Naval Stores Act	6
Meat Inspection Act	6
Insecticide Act	7
Filled Milk Act	7
Acts governing importation or interstate movement of livestock	8
Twenty-eight hour law	8
Plant Quarantine Act	9
Federal Highway Act and supplemental acts	10
Federal Seed Act	10
Conservation and Marketing Division	11
National forests	11
Export Apple and Pear Act	12
Peanut Statistics Act	12
Cotton Statistics Act	13
Tobacco Inspection Act	13
Perishable Agricultural Commodities Act	13
Produce Agency Act	14
Conservation and Marketing Division—Continued.	
United States Standard Container Act	14
Commodity Exchange Act	15
Packers and Stockyards Act	15
Wildlife Conservation	17
Migratory Bird Treaty Act	18
Migratory Bird Conservation Act	18
Migratory Bird Hunting Stamp Act	18
Bird and Animal Reservation Trespass Act	18
Lacey Act	18
Upper Mississippi River Wildlife and Fish Refuge Act	18
United States Warehouse Act	20
United States Grain Standards Act	20
Fiscal Division	21
Claims	22
Patents	23
Title Division	24
Market Stabilization Division	24
Agricultural Adjustment Division	26
Land Policy Division	27
Farm Security Division	29
Community Project Division	31

DIVISIONAL CHANGES IN THE OFFICE

During the year, several changes were made in the designations of the divisions of the Office, in order more accurately to express their actual functions, and the reorganization of some of the divisions was also effected.

The name of the National Forest Division was changed, first, to the Marketing Regulation-Forest and Wildlife Conservation Division and, later, was shortened to Conservation and Marketing Division; the Soil Conservation-Domestic Allotment Division became the Agricultural Adjustment Division; and the designation of the Marketing, Marketing Agreements, and Orders Division was changed to Market Stabilization Division.

The Resettlement Division, as such, was discontinued, its functions having been transferred to two new divisions. To one of these, the Farm Security Division, was assigned all the legal work arising in connection with the Department's administration of the farm tenancy program under title I of the Bankhead-Jones Farm Tenant Act and of the rural rehabilitation program under title II of the Bankhead-Jones Farm Tenant Act and under the provisions of the Emergency Relief Appropriation Acts relating to loans, relief, and rural rehabilitation for needy persons. Two separate sections were established in the Farm Security Division, the Rehabilitation Section and the Farm Loan Section. The second of the new divisions, which succeeded the Resettlement

Division, is the Community Project Division, to which was assigned all the legal work incident to the completion and management of the several suburban and rural resettlement projects of the Department. The Community Project Division is composed of two sections, the Community Organization Section and the Community Management Section.

The former Food and Drugs Division and the Animal and Plant Quarantine Division were combined to form the Health and Quarantine Division, comprising two sections; namely, the Health Section and the Quarantine Section.

At the close of the year, there were in the Office 143 professional, 1 subprofessional, 206 clerical, and 14 custodial employees stationed in Washington, D. C., and there were 86 professional and 80 clerical employees stationed in the field, making a total of 530 employees. Through their energy and faithfulness, the work of the Office has been conducted economically, expeditiously, and effectively. There follows a summary of that work, in statistical form, and the details of the legal work performed in the Office in connection with a large number of the statutes entrusted to this Department for administration and enforcement.

GENERAL SUMMARY OF WORK

Upwards of 1,850 formal, written opinions on legal questions were given to administrative officials of the Department. Necessarily, no record has been kept of the legal advice given, from day to day, to bureau or other departmental officials during conference, by telephone, or by brief, informal opinions written on, or in connection with, papers, proposed correspondence, or orders referred to this Office for criticism and advice.

There were 1,310 notices of judgment prepared for publication, under the authority of the Food and Drugs, Insecticide, and Federal Caustic Poison Acts.

There were prepared, for prosecution by the Attorney General, 941 cases of alleged violations of regulatory statutes entrusted to this Department for administration and enforcement, and, in addition to the list of such prosecutions as are given in table 1, specifying the number of cases in which fines, penalties, or damages were recovered and the amounts so recovered, there were 2,335 decrees of condemnation entered as the result of violations of the Food and Drugs and Insecticide Acts.

Table 1 describes the various statutes for violations of which report was, or had been, made to the Department of Justice and in which fines, penalties, or damages were recovered. Shown also are the amounts so recovered.

TABLE 1.—*Cases in which fines, penalties, or damages were recovered*

Law involved	Cases	Amount paid	Law involved	Cases	Amount paid
	Number	*Dollars*		*Number*	*Dollars*
Animal quarantine acts	16	2,100.00	Migratory Bird Treaty Act	576	12,456.00
Bird and Animal Reservation Trespass Act	11	142.00	Packers and Stockyards Act	16	1,150.00
Commodity Exchange Act	1	1,000.00	Perishable Agricultural Commodities Act	8	6,060.00
Export Apple and Pear Act	1	500.00	Plant Quarantine Act	1	130.00
Federal Caustic Poison Act	4	485.00	Produce Agency Act	1	100.00
Federal Seed Act	2	250.00	Twenty-eight-hour law	283	29,200.00
Food and Drugs Act	252	47,033.62	United States Standard Container Act	1	15.00
Insecticide Act	51	4,483.50	Upper Mississippi Wild Life and Fish Refuge Act	5	105.00
Lacey Act	10	1,450.00			
National forest laws	374	52,971.93			
Meat Inspection Act	27	735.50			
Migratory Bird Conservation Act	3	45.00	Total	1,720	160,764.05
Migratory Bird Hunting Stamp Act	77	351.50			

In addition to the cases listed in table 1, a number of apparent violations of these regulatory statutes was submitted to the Office by administrative officials and were given careful consideration, but the facts submitted were not, and apparently could not be made, convincing enough to warrant prosecution, and they therefore were not reported to the Department of Justice.

Table 2 summarizes the number of contracts and leases which were prepared or reviewed by the Office.

TABLE 2.—*Contracts and leases prepared or reviewed*

Bureau or office	Contracts	Leases	Total
	Number	*Number*	*Number*
Agricultural Adjustment Administration	87	40	127
Agricultural Economics	17	45	62
Animal Industry	6	25	31
Biological Survey	16	7	23
Chemistry and Soils	3	0	3
Dairy Industry	5	0	5
Entomology and Plant Quarantine	10	12	22
Public Roads	5,633	26	5,659
Commodity Exchange Administration	0	5	5
Farm Security Administration	1,933	258	2,191
Food and Drug Administration	4	0	4
Forest Service	2,904	13	2,917
Solicitor	19	3	22
Soil Conservation Service	14	231	245
Weather	103	33	136
Total	10,754	698	11,452

HEALTH AND QUARANTINE DIVISION

FOOD AND DRUGS ACT

(34 Stat. 768)

At the beginning of the fiscal year, 527 cases were pending in the courts under the Federal Food and Drugs Act. Of these, 240 were criminal and 287 were civil cases. There were 224 criminal cases, involving 1,562 violations, and 2,609 civil cases, a total of 2,833 cases, reported to the Department of Justice. There were thus pending, during the year, 464 criminal cases and 2,896 civil cases, a total of 3,360. There were terminated 291 criminal cases and 2,518 civil cases, a total of 2,809, leaving 173 criminal cases and 378 civil cases, or a total of 551 cases, pending at the close of the year.

The 291 criminal cases disposed of were terminated as follows:

Disposition:	*Cases*
Pleas of guilty and fines	183
Pleas of nolo contendere and fines	64
Nolle prosequi or dismissal	31
Verdicts of guilty and fines	3
Verdicts of not guilty	5
Plea of guilty; imposition of sentence deferred	2
Plea of nolo contendere; imposition of sentence suspended	1
Verdict of guilty; imposition of sentence suspended	1
Plea of guilty—placed on probation for 1 year	1
Total	291

The fines imposed in criminal cases are shown in table 3.

TABLE 3.—*Fines imposed in criminal cases (exclusive of costs) under the Food and Drugs Act*

Cases (number)	Amount of fine	Total	Cases (number)	Amount of fine	Total	Cases (number)	Amount of fine	Total
1	$4.00	$4.00	1	$55.00	$55.00	5	$250.00	$1,250.00
6	5.00	30.00	1	57.00	57.00	1	270.00	270.00
4	10.00	40.00	2	60.00	120.00	13	300.00	3,900.00
1	11.00	11.00	2	65.00	130.00	1	303.00	303.00
1	12.50	12.50	7	75.00	525.00	4	400.00	1,600.00
2	15.00	30.00	1	80.00	80.00	6	500.00	3,000.00
1	17.00	17.00	1	90.00	90.00	7	600.00	4,200.00
8	20.00	160.00	30	100.00	3,000.00	1	750.00	750.00
34	25.00	850.00	2	110.00	220.00	1	800.00	800.00
1	26.00	26.00	1	125.00	125.00	1	850.00	850.00
1	27.00	27.00	11	150.00	1,650.00	3	1,000.00	3,000.00
2	28.00	56.00	1	160.00	160.00	1	1,200.00	1,200.00
6	30.00	180.00	1	175.00	175.00	1	1,250.00	1,250.00
2	35.00	70.00	1	180.00	180.00	1	1,750.00	1,750.00
7	40.00	280.00	16	200.00	3,200.00	1	2,100.00	2,100.00
1	43.00	43.00	1	200.12	200.12	1	3,018.00	3,018.00
39	50.00	1,950.00	1	204.00	204.00	1	3,300.00	3,300.00
1	52.00	52.00	1	205.00	205.00			
1	53.00	53.00	1	225.00	225.00	Total		47,033.62

The 2,518 civil cases that were disposed of involved products that had been seized as being in violation of the statute. These cases were terminated in the following manner:

Disposition:	Cases
Default decrees of destruction	1,637
Consent decrees of destruction	160
Consent decrees; goods released under bond for reconditioning	512
Dismissed (chiefly because no seizure of the goods had been effected)	191
Judgment for claimant	7
Judgment for Government	2
Default decree of condemnation, forfeiture, and sale	4
Consent decree of condemnation, forfeiture, and sale	4
Default decree of condemnation and forfeiture; goods released	1
Total	2,518

1,200 notices of judgment were prepared and published during the year.

CASES OF INTEREST

The case of *United States of America* v. *Moscahlades Bros., Inc., a corporation, Socrates Moscahlades and Adolphus Brook* is of special interest.

In this case, an information in 18 counts was filed in the United States District Court for the Southern District of New York on July 27, 1937, charging the defendants with shipping in interstate commerce olive oil that had been adulterated with tea-seed oil. Because of the fact that the then-known chemical tests for olive oil and for its adulterant, tea-seed oil, gave similar results, it was necessary to develop a positive and reliable test for a mixture of tea-seed oil and olive oil before this case could be instituted.

The defendants entered pleas of not guilty and the case was called for trial on October 4, 1937, with the Government fully prepared to show, by the new test, that the defendants' product, labeled as pure imported virgin olive oil pressed from fresh picked selected olives, contained as much as 40 percent of tea-seed oil.

On the day set for the trial, the defendants unexpectedly withdrew their pleas of not guilty and entered pleas of guilty, but their attorney pointed out that his clients' product was not injurious to health and, since it contained no harmful or deleterious ingredient, the fine should be nominal. The court, in imposing one of the highest fines for violation of the act during the year and also a jail sentence, suspended, as to one of the individual defendants, pointed out that the product was a fraud upon the public and just as much a violation of the act as if it had contained harmful or deleterious ingredients.

The case of *United States* v. *Alvin A. Baumer*, trading as *Baumer Food Products Co.*, was tried in the United States District Court for the Eastern District of Louisiana, on April 7, 8, and 13, 1938, before the court, a jury having been waived. The information contained two counts charging a violation of the act in the adulteration and misbranding of a product labeled "Ketchup", but which consisted of a mixture of tomato pulp, apple pulp, vinegar, salt, and spices, artificially colored. It was the Government's contention that a product labeled "Ketchup", packed in a small, long-necked bottle with screw cap, characteristic of containers used for tomato catsup, and having a red color, means to the consumer in the United States tomato catsup, a product made entirely from tomatoes and spices, and with or without artificial color or preservative. The defendant contended that the word "Ketchup", unqualified, does not mean tomato catsup and referred to the dictionary definition of ketchup as "a table sauce made, usually, of mushrooms, tomatoes, or walnuts, with vinegar or wine and spices." In finding the defendant guilty, the court commented that the product had every appearance of tomato catsup, a product that does not contain apple pulp.

The cases of *United States* v. *Certain Quantities of "Creamed Old English Cheese", Kraft-Phenix Cheese Corporation, claimant*, were based upon libels filed in the United States District Court for the District of Minnesota for the condemnation and confiscation of quantities of a product labeled, in part, "Creamed Old English Cheese * * * Rare, Sharp, Old Cheddar, unmistakably." The libels alleged the product was adulterated and misbranded in violation of the act because the product contained added red pepper.

On November 19 and 20, 1937, three cases were consolidated for trial and tried before the court, a jury having been waived. The Kraft-Phenix Cheese Corporation, claimant, by stipulation, admitted the addition of red pepper to the cheese. On January 17, 1938, the court found the Creamed Old English Cheese

adulterated and misbranded because of the undeclared presence of cayenne pepper. An appeal from this decision is now pending in the circuit court of appeals.

On March 8 and 9, 1937, the case of *United States* v. *492 cases of Orange Juice, each case containing two 1-gallon jugs*, was tried in the district court of the United States for the Eastern District of Louisiana, a jury having been waived. The Nesbit Fruit Products, Inc., of Los Angeles, Calif., filed a claim to the goods and, in its answer, denied that the article was adulterated or misbranded as alleged in the libel. The product was labeled "Orange Juice Sweetened" and consisted of orange juice, cane sugar, fruit acid, color, and 0.1 percent benzoate of soda. The article was shipped in 1-gallon glass jars and used as a base for making an orange beverage at soda fountains. The gallon jar is placed in a dispenser on the soda bar, and 1 ounce of the Nesbitt's Orange Juice Sweetened is measured into a 6-ounce glass and the glass filled with ice and water in the presence of the customer. The article in the gallon jar contains about 50 percent of added sugar. Due to the high tinctorial power of the coal-tar color used, the color of the article is about five times as intense as it would be without the added artificial color. Therefore, when 1 ounce of this product is diluted with five parts of water and ice, the beverage thus prepared has the appearance of fresh fruit orange juice and tastes like sweetened orange juice.

It was the Government's contention that, when the highly colored product contained in the gallon jar was diluted with water and ice, the consumed drink had the golden appearance and taste of sweetened orange juice, which its name implied, but that, in fact, it contained only a small proportion of orange juice and that deception as to juice and vitamin content thereby was practiced on the consumer. The Government further contended that sweetened orange juice had a definite trade and consumer meaning; that is, an article without more than 15 percent of added sugar.

The attorneys for the claimant contended that the article shipped in interstate commerce was not consumed as such and that the amount of orange juice in the finished drink is not concealed by the added color since the drink is prepared in the presence of the customer.

On September 13, 1937, the court, in its findings of fact and conclusions of law dismissing the libel, found that the Government had failed to establish, by clear and satisfactory evidence, that the added color made the product adulterated. The court also found that there was no standard as to sugar content for "Orange Juice Sweetened" and that the labeling of the article was not false and misleading.

From this decision, the Government appealed to the Circuit Court of Appeals for the Fifth Circuit, and, on May 24, 1938, the appellate court, with Rufus E. Foster, presiding judge, dissenting, affirmed the judgment of the district court.

The case of *United States of America* v. *Sharp & Dohme, Inc.*, which was tried in the district court of the United States for the Eastern District of Pennsylvania, is also one of special interest.

The information contained two counts. Count 1 charged the interstate shipment of a drug labeled, in part, "Pituitary Extract Obstetrical * * * 10 International Units per cc" which was adulterated, in violation of the act, in that it possessed a potency of twice its labeled strength. Count 2 charged misbranding of the drug. The defendant admitted the interstate shipment and the identity of the sample and that it was representative of the shipment.

Pituitary extract is a drug recognized in the United States Pharmacopoeia and is one of the important drugs depended on by physicians in their practice of medicine. It is obtained from a certain gland of animals used for food by man and is prepared by removing this particular gland from the animal immediately after slaughter, drying it, powdering it, and extracting its medicinal properties with a dilution of acetic acid. The drug is extremely potent, as is illustrated by the fact that a single ounce of the dried gland is sufficient to make 6 quarts of the extract and as little as 2 drops of the solution may be a therapeutic dose. Because of the powerful action of Pituitary Extract Obstetrical, a small excess of the drug may have a dangerous action, and when such excess is administered there is no antidote.

The United States Pharmacopoeia describes a very delicate and extremely complicated biological method of assaying or testing the potency of pituitary extract. The Pharmacopoeia first gives explicit directions for the manufacture

of a standard pituitary powder, which is the yardstick or gage by which the potency of pituitary extract is measured. The Pituitary extract to be tested is applied to the uterus from a virgin guinea pig suspended in a nutrient solution, and the contraction obtained is compared with the contraction of the standard pituitary powder, on the same muscle. The strength of the standard pituitary powder is then varied until the submaximal contractions of the pituitary extract to be tested and of the standard pituitary powder are found to be equal, in at least two successive pairs of contractions. It is then a matter of calculation to determine the strength of the pituitary extract to be tested.

On January 3, 1938, the case was tried before the court, a jury having been waived. At the conclusion of the evidence, there was such an apparent divergence of opinion among the experts on both sides as to the strength of the drug that the court ordered a joint assay to be conducted. The purpose of these assays was to see whether acceptable assays in both laboratories would show similar or divergent results on the same material. The defendant's experts conducted assays at its laboratories, at which the Government's experts were present, and later the Government's experts conducted assays at its laboratories in the presence of defendant's experts.

At the conclusion of these joint assays, oral arguments were heard by the court on June 17, and on June 23 the defendant was found guilty, as charged in both counts of the information. The defendant has indicated that an appeal may be taken.

THE NEW FEDERAL FOOD, DRUG, AND COSMETIC ACT

On June 25, 1938, the President approved a new Federal Food, Drug, and Cosmetic Act which will eventually supplant the act of 1906, as amended. The provisions of the new law, with respect to dangerous drugs, new drugs, and injurious cosmetics, took effect immediately, but its remaining provisions will not take effect for 1 year.

FEDERAL CAUSTIC POISON ACT

(44 Stat. 1406)

At the beginning of the year, four criminal cases were pending. During the year two criminal cases were reported to the Attorney General. No civil cases were reported. Of the criminal cases five were terminated as follows: Four by pleas of guilty and the imposition of fines amounting to $485, and one case was dismissed. At the close of the year, one criminal case was pending.

Thirty-five notices of judgment were prepared and published.

NAVAL STORES ACT

(42 Stat. 1430)

No cases were pending at the beginning of the year and no cases were instituted.

MEAT INSPECTION ACT

(34 Stat. 1260)

At the beginning of the year, 38 cases were pending. During the year 31 additional cases were reported to the Attorney General for prosecution. There were thus pending during the year 69 cases, 44 of which were disposed of as follows: 1 by verdict of guilty; 24 by pleas of guilty, and 2 by pleas of nolo contendere, under which fines were imposed; and 17 cases were dismissed. Twenty-five cases were pending at the close of the year.

The fines imposed are shown in table 4.

TABLE 4.—*Fines imposed in meat-inspection cases*

Cases (number)	Fines in each case	Total fines	Cases (number)	Fines in each case	Total fines	Cases (number)	Fines in each case	Total fines
1	$1.00	$1.00	1	$15.00	$15.00	1	$100.00	$100.00
3	5.00	15.00	12	25.00	300.00			
1	7.50	7.50	1	27.00	27.00	Total (27)		735.50
2	10.00	20.00	5	50.00	250.00			

CASE OF INTEREST

The case of *United States of America* v. *Birney F. Combs*, which was tried in the district court of the United States for the District of Vermont on March 4, 1938, before the court and a jury, is one of special interest.

It was charged in the indictment filed that the defendant shipped in interstate commerce during the first 3 days of March 1937, 48 calf carcasses, 799 pounds of boned veal, and 141 pounds of calf lungs, livers, and hearts, which had not been inspected, examined, and marked as required by the Meat Inspection Act of March 4, 1907.

The defense was that the Meat Inspection Act exempts, from its requirements as to inspection, the cattle slaughtered by a farmer on the farm and that the defendant was within the exempted class. The Government proved to the satisfaction of the jury that a person slaughtering and shipping in interstate commerce the amount of meat that was shipped by this defendant could no longer be considered a farmer within the meaning of the law and that his principal occupation was that of operating a slaughterhouse. The jury found the defendant guilty of shipping uninspected meat in interstate commerce and the court assessed a nominal fine, which was paid.

MEAT INSPECTION ACT AMENDED

On June 29, 1938, the President approved an amendment to the Meat Inspection Act of March 4, 1907, wherein the terms "farmer," "retail butcher," and "retail dealer," were specifically defined.

INSECTICIDE ACT

(36 Stat. 331)

At the beginning of the year, 35 cases were pending under the act, 28 of which were of criminal cases and 7 of which were civil or seizure cases. During the year, 63 cases were reported to the Attorney General. In 45 cases, criminal prosecutions and, in 18 cases, civil or seizure actions against the products were recommended.

Of the 73 criminal cases pending at the beginning of, or reported during, the year, 51 cases were disposed of as shown in table 5, leaving 22 criminal cases pending at the close of the year.

TABLE 5.—*Disposition of criminal cases under the Insecticide Act, fiscal year 1938*

Cases (number)	Disposition	Fines
38	Pleas of guilty	$4,028.50
7	Pleas of nolo contendere	455.00
1	Verdict of not guilty	
5	Dismissed	
Total		4,483.50

Of the 25 civil or seizure cases, either pending at the beginning of or reported during the year, 15 were terminated by the entry of default decrees of condemnation and destruction and five were dismissed, leaving five civil or seizure cases pending at the close of the year.

Seventy-five notices of judgment were prepared and published.

FILLED MILK ACT

(42 Stat. 1486)

On April 25, 1938, the Supreme Court of the United States, in its opinion in the case of *United States* v. *Carolene Products Co.*, upheld the constitutionality of the Filled Milk Act of March 4, 1923. This act prohibits the shipment in interstate commerce of milk, cream, or skimmed milk compounded or blended with any fat or oil other than milk fat so that the resultant product is in imitation or semblance of milk, cream, or skimmed milk, whether or not condensed, evaporated, concentrated, powdered, dried, or desiccated.

ACTS RELATING TO THE INTERSTATE MOVEMENT OF LIVESTOCK FROM QUARANTINE DISTRICTS, OR PROHIBITING THE INTERSTATE MOVEMENT OF DISEASED LIVESTOCK

(23 Stat. 31; 26 Stat. 414; 32 Stat. 791; 33 Stat. 1264)

One case was reported to the Attorney General for prosecution under the act of May 29, 1884 (23 Stat. 31). Of the cases pending at the close of the preceding fiscal year, three were terminated by fines of $100 each, one by a fine of $200, and one by dismissal. There were four cases pending at the close of the year.

Eighteen cases were reported to the Attorney General for prosecution under the act of February 2, 1903 (32 Stat. 791), of which six were terminated by fines of $100 each, one by a fine of $150, one by a fine of $200, and one by a fine of $300. Of the cases pending at the close of the preceding fiscal year, one was terminated by a fine of $50, three by fines of $100 each, and three by dismissal. There were 13 cases pending at the close of the year.

No cases were reported to the Attorney General for prosecution under the act of March 3, 1905 (33 Stat. 1264), and no cases were pending at the close of the preceding year.

In all, 19 cases were reported to the Attorney General and 17 were pending at the close of the year. In the enforcement of these laws, one case was terminated by a fine of $50, 12 by fines of $100 each, one by a fine of $150, one by a fine of $200, and one by a fine of $300.

Nine bonds to insure the handling in this country, in accordance with the regulations of this Department, of restricted import animal byproducts were examined.

CASES OF INTEREST

The so-called Texas cattle-dipping cases, *Russell and Tucker et al., Porter Brothers and Biffle et al.*, and *Henry Price et al.* v. *United States*, which were authorized by acts of Congress approved May 9, 1934 (48 Stat. 1350 and 1352), and which were based on allegations of negligence on the part of Government inspectors in the dipping of cattle in 1918, 1919, and 1922, were finally decided in favor of the plaintiffs in the United States District Court for the Northern District of Texas on September 14, 1936. The total amount of damages awarded was about $617,000.

Shortly after the decision was announced, recommendations were made by this Department to the Department of Justice for the appeal of these cases, on the ground that they had been decided contrary to the evidence and to the requirements of the acts of Congress authorizing the suits, and, in February 1937, the Solicitor General authorized appeals to be taken from all three judgments. These appeals were heard on January 27, 1938, in the Circuit Court of Appeals for the Fifth Circuit and, on March 22, 1938, the appellate court, as reported in 95 F. (2d) 687, unanimously held that the plaintiffs had not proved the negligence on the part of the Government inspectors which the enabling acts required for a recovery. As Judge Hutcheson put it, in his separate opinion in the *Henry Price et al.* case, "the proof completely fails to show negligence."

A motion by the plaintiffs for rehearing was denied on April 16 and, on March 11, the plaintiffs filed petitions for writs of certiorari.

THE 28-HOUR LAW

(34 Stat. 607)

Two hundred and twenty-one cases were reported to the Attorney General under the 28-hour law, prohibiting the knowing and willful confinement of livestock, shipped in interstate commerce, for more than 28 hours (or 36 hours, under certain circumstances) consecutively, without being unloaded, for 5 hours, for food, water, and rest. Penalties aggregating $29,200 were recovered in 283 cases. Thirty-four were dismissed and the trial of one case resulted in judgment for the defendant.

Two hundred and thirty-one cases were pending at the close of the year.

CASE OF INTEREST

On March 22, 1933, the Government brought suit in the Federal court for the Eastern District of Louisiana against the Illinois Central Railroad Co. to recover the penalty provided by the 28-hour law for knowingly and willfully confining certain cattle in a car during interstate transportation for a period longer than that permitted by the act.

The defendant admitted that it had confined the animals for the period alleged, but denied that it had knowingly and willfully so confined them, saying that its failure to unload them in time was due to the neglect of its night general yardmaster to notify another employee, whose duty it was to unload them, that the animals would be delivered in the early hours of the morning of a particular day. Thus, the issue was substantially whether the failure to unload animals in accordance with the statute, caused by the negligence of an employee, was a knowing and willful failure attributable to the carrier. This question had frequently engaged the attention of the courts, and the district courts and the circuit courts of appeals, by which it had been considered, were about evenly divided in their opinions. Efforts to carry the question to the Supreme Court had previously been balked by procedural difficulties.

Judgment for the defendant in the district court was affirmed by the Circuit Court of Appeals for the Fifth Circuit and the case was carried to the Supreme Court on a writ of certiorari. The Court, on February 28, 1938, reversed the lower courts and held that indifference, inadvertence, or negligence of employees cannot be held to excuse overconfinements under the act (58 Sup. Ct. 533).

It is believed that this decision will eliminate many of the difficulties which have attended the enforcement of the 28-hour law.

PLANT QUARANTINE ACT

(37 Stat. 315)

Prosecution was instituted under this act by the Department of Justice, on a form of information prepared in this Office, against Carl A. Hansen Nursery for violation of the white-pine blister rust quarantine by making five shipments of currant plants from South Dakota to points in Minnesota, Idaho, and Pennsylvania without having attached thereto the control-area permits required by the regulations supplemental to said quarantine. This case was pending at the close of the year.

The Department of Justice similarly prosecuted Billy Sjulin and others, doing business as Interstate Nurseries, for 13 shipments of plants from Iowa to various places in Idaho, Michigan, Massachusetts, and New York without the required control-area permits being attached thereto. In this case, the defendants pleaded guilty and were fined $10 on each of the 13 counts, making a total fine of $130.

Prosecutions under the act were also instituted, on the forms of information furnished by this Office, in 21 additional instances: One for violation of the gypsy moth quarantine, in which a fine of $25 was imposed; and 20 for violations of Japanese beetle quarantine, in which the total of the fines imposed was $600 (table 6).

Conferences were held, hearings were attended, and assistance was given in connection with the revision, revocation, or amendment of existing plant quarantines and regulations, as follows: Revision of the black stem rust quarantine (No. 38); revision of the fruit and vegetable quarantine (No. 48); revision (twice) of the regulations supplemental to the pink bollworm quarantine (No. 52); revision of white-pine blister rust quarantine (No. 63) and regulations supplemental thereto; revision of the Mexican fruitfly quarantine (No. 64) and regulations supplemental thereto; revision of regulations supplemental to Dutch elm disease quarantine (No. 71); revision (twice) of the regulations governing the importation of cotton and cotton wrappings; and revision of regulations governing the movement of plants into, and out of, the District of Columbia.

TABLE 6.—*Fines imposed in criminal cases (exclusive of costs, which were generally assessed) under the Plant Quarantine Act*

Cases (number)	Quarantine	Amount of fine	Total
1	Gypsy moth	$25	$25
1	Japanese beetle	100	100
1	do	50	50
18	do	25	450
1	White pine	130	130
Total (22)			755

FEDERAL HIGHWAY ACT AND SUPPLEMENTAL ACTS

(42 Stat. 212; 46 Stat. 805; 47 Stat. 709; 48 Stat. 195, 993; 49 Stat. 115)

During the fiscal year, 1,138 original and 460 revised project statements, submitted by the State highway departments involving Federal-aid road projects, were first reviewed to determine whether they were eligible under the law and were then recommended for approval by the Secretary. Original and revised project statements were similarly reviewed for 17 Federal-lands highway projects and 4 flood-relief projects, making a total of 1,619 project statements so reviewed.

There were 3,155 original project agreements and certificates of approval of plans, specifications, and estimates, prepared by the Bureau of Public Roads, reviewed as to their form and the sufficiency of their execution by the State highway departments and approved for execution by the Secretary or his authorized representatives. Drafts of 2,151 modified project agreements and certificates of approval of plans, specifications, and estimates, prepared by the Bureau of Public Roads for execution by the State highway departments and the Secretary or his authorized representatives, were similarly reviewed. The project agreements and modified project agreements executed involved work estimated to cost $304,644,864.97. These projects, all in all, involved the improvement of 10,566.8 miles of road.

In addition to the foregoing, 1 original and 66 modified project agreements and certificates of approval of plans, specifications, and estimates, for National Recovery Work Relief projects, prepared by the Bureau of Public Roads and executed by the highway departments, were reviewed and approved for execution by the Secretary or his authorized representatives. These projects involved construction work on 57.7 miles of road, estimated to cost $583,371.85.

Two modified and fifty-seven original project agreements involving flood-relief projects, at an estimated cost of $2,998,464.72 and involving 67.5 miles of road, were reviewed and recommended for execution, as were also 21 original and 12 modified project agreements for Federal-lands highway projects, which involved work on 222.4 miles of roadway at an estimated cost of $1,916,027.21.

Summarizing the above, there were handled 7,084 separate sets of project papers, providing for construction work on 11,004.4 miles of road at an estimated cost of $310,142,728.75.

There were also 81 cooperative agreements between the Department and cooperating agencies for constructing roads within or partly within national forests, and 86 original construction contracts were entered into after advertisement and award for the construction of such roads. All these cooperative agreements and construction contracts, including the consideration of bids and awards based thereon, were considered as to form, substance, and sufficiency prior to recommendation for action thereon by the Secretary.

FEDERAL SEED ACT

(37 Stat. 506)

At the beginning of the year, there were eight criminal and three seizure cases pending under this act.

One criminal and eight seizure cases were reported to the Attorney General. Of the nine criminal cases thus pending or instituted, seven were terminated

as follows: One by a plea of guilty and the imposition of a fine of $200; one by a verdict of guilty and a fine of $50, and five cases were dismissed. The 11 seizure cases, thus pending or instituted, were terminated as follows: Eight by default decrees of destruction; one by default decree of condemnation, forfeiture, and sale; and two were dismissed.

At the close of the year, there were, therefore, two criminal and no civil cases pending.

CASE OF INTEREST

The Belt Seed Co., of Baltimore, Md., brought into Syracuse, N. Y., in the spring of 1937, for importation into the United States, 50 bags of red clover seed, each bag containing 150 pounds and consisting of 50 percent of Canadian-grown red clover seed and 50 percent of American- (Oregon) grown red clover seed. All this seed, that is, both the Canadian and the American seed, had been stained 1 percent iridescent violet by the importer, who claimed that thereby he had complied with regulation 8 (b) of the Federal seed regulations. The Department, however, believed that the regulation had not been complied with, in spite of the coloring of the seed, and refused to give its consent to the collector of customs at Syracuse for the release of the seed. The Belt Seed Co., however, on July 6, 1937, filed a petition for mandamus in the District Court of the United States for the District of Columbia, directed to the Secretary and other officials of the Department, to require them to certify to the collector of customs at Syracuse that the seeds in question had been found to comply with the provisions of the Federal Seed Act.

The controversy turned wholly on the meaning of the words in regulation 8 (b) which required 1 percent staining, in iridescent violet, of "seeds of alfalfa or red clover and any mixture of seeds containing 10 percent or more of the seeds of alfalfa and/or red clover grown in Canada."

The plaintiff claimed that this phraseology meant that any mixture of seeds, no matter where some of the seeds were grown, might be imported if the mixture was stained 1 percent iridescent violet. The Department's contention, on the other hand, was that the words "grown in Canada" applied not only to the alfalfa and red clover specifically mentioned in the regulation, but also to the entire mixture of seeds; that what was meant was that any mixture of seeds which were grown in Canada and which contained 10 percent or more of Canadian alfalfa or red clover seeds, must, like Canadian alfalfa or red clover, be stained, as a whole, 1 percent iridescent violet. It was also pointed out that the final words of this subparagraph (b) showed that it related only to Canadian seed by providing that "such seeds grown in any other country or region shall be stained green."

This case was heard on March 10, 1938, with the result that judgment was given for the plaintiff and writ of mandamus, as petitioned for by plaintiff, was ordered to issue.

The basis of the court's decision was that the meaning of the regulation was not clear and that it was possible to interpret its meaning as the plaintiff had done.

Amendments of regulations 8, which will prevent any recurrence of such a misunderstanding, have been drawn and submitted to the Secretary of the Treasury for the concurrence of that Department.

CONSERVATION AND MARKETING DIVISION

NATIONAL FORESTS

(30 Stat. 35)

One hundred and thirty claims to land within the national forests, initiated under the public-lands laws of the United States, were handled by the Office.

There were handled 1,751 complaints, information, protests, etc., affecting the national forests. Attorneys of the Office also participated in the trial of 21 Federal cases and 515 cases under State laws affecting the forests and handled 414 other matters involving litigation and settlement.

The amount of damages awarded and the fines imposed in 374 trespass cases are shown in table 7.

TABLE 7.—*Damages and fines in trespass cases*

Character of trespass	Cases	Damages	Fines
Grazing	58	$5,238.09	$28.71
Fire	80	21,963.43	687.00
Timber	35	4,505.67	316.00
Property	32	2,839.43	53.50
Occupancy	5	90.00	300.00
Miscellaneous	164	13,870.30	3,132.80
Total	374	48,506.92	4,518.01

CASES OF INTEREST

Baldrich et al. v. *Barbour*, 90 F. (2d) 867. The plaintiffs claimed title to approximately 6,000 acres of land within what is now known as the Caribbean National Forest, but which, at that time, was called the Luquillo National Forest. They brought suit against the forest supervisor for the recovery and possession of the land. Two similar suits had been filed against former forest supervisors and were decided adversely to the plaintiffs. The only evidence of occupation of the land on the part of the plaintiffs was the cutting of some timber. The court said that merely going on the land and cutting timber without fixing the boundaries of the land claimed did not amount to adverse possession. The possession of the land by the forest supervisors for more than 20 years in good faith and under proper title was held to establish title in the United States.

In the case of *United States* v. *James Richard Champion*, Equity No. 195, in the United States District Court for South Dakota, the Government sought an injunction to restrain the defendant from occupying certain land within the Harney National Forest and Custer State Park Game Sanctuary. The defendant contended in his answer to the complaint that he had the right to occupy the land under a mining location known as the "Expectation Lode Mining Location" because of the provision in the National Forest Administrative Act of June 4, 1897, authorizing mineral locations in the national forest. The Government filed a demurrer to the answer on the ground that the land, being in a game sanctuary, was not subject to mineral location and that the location was, therefore, void and of no effect. The demurrer was sustained by the court in an order filed May 19, 1938. The defendant failed to plead further and a decree pro confesso was entered.

EXPORT APPLE AND PEAR ACT

(48 Stat. 123)

CASE OF INTEREST

In the case of *United States* v. *Wyatt H. Richard*, in the United States District Court for the Western District of Virginia, the defendant, who was charged with the violation of this act, plead guilty and was fined $500 and costs. The violations charged were (1) the shipment of lots of apples in export, which, when delivered to the railroad companies and then to the steamship lines, were not accompanied by the required certificates of inspection; (2) the tender of certificates to the carriers by the defendant some 4 weeks after the dates of shipments, which certificates covered entirely different lots of apples than those which he exported; (3) the removal from the packages of the grade mark previously certified for the lots of apples and superimposing with a rubber stamp a higher grade; and (4) the offering for shipment in export of one large lot of apples which had been previously inspected and certified as failing to meet the minimum of quality required for shipment in export.

PEANUT STATISTICS ACT

(49 Stat. 1898)

This act was amended by the act of May 12, 1938, Public, No. 507, to provide (1) for obtaining information as to peanuts received and shipped, as well as those in storage; (2) for obtaining reports from salters and manufacturers of

peanut products; and (3) for exemption, in the discretion of the Secretary of Agriculture, of salters and manufacturers using less than 30,000 pounds. The provision in the original act authorizing the Secretary to collect and publish statistics of the quantity of peanuts picked or threshed by owners and operators of picking and threshing machines was made mandatory.

COTTON STATISTICS ACT

(44 Stat. 1372)

By an act approved June 14, 1938, Public, No. 600, the original act was amended to require cotton ginners to keep a record by counties of the number of bales of cotton ginned.

TOBACCO INSPECTION ACT

(49 Stat. 731)

In last year's report, mention was made of the adverse decision of Judge Meekins of the Federal court for the Eastern District of North Carolina in the case of *Currin et al.* v. *Wallace*, 19 F. Supp. 211. That decision was reversed by the circuit court of appeals on April 5, 1938, 95 F. (2d) 856. The appellate court held that the regulation of the auction sales of tobacco is within the power of Congress under the commerce clause of the Constitution. The facts showed that a large percentage of the tobacco sold actually moved to destinations outside of the State immediately following sale. The court also held that there was no unlawful delegation of power to the Secretary of Agriculture or to the growers. While the act vests the Secretary with administrative discretion, it indicates, at the same time, the standards by which the discretion is to be exercised. The provision for the referendum by the growers was held not to be a delegation of power to them but a limitation on the Secretary's administrative discretion. The fact that the law becomes applicable to some markets and not to others does not deny due process of law to the warehousemen at the designated markets, according to the court's decision.

The warehousemen, Currin et al., on August 15, 1938, filed in the Supreme Court a petition for certiorari. The case is designated as *Currin et al.* v. *Wallace*, No. 275.

PERISHABLE AGRICULTURAL COMMODITIES ACT

(46 Stat. 531; 48 Stat. 584; 49 Stat. 1533; 50 Stat. 725)

In proceedings under this act, the Secretary issued 246 reparation orders, revoked 7 licenses, suspended 19 licenses, and ordered dismissal of 64 complaints. The total reparations awarded amounted to $87,414.29. At the beginning of the year there were 18,077 produce dealers', commission merchants', and brokers' licenses under the act, and during the year this number was increased to 19,779.

Eight cases were referred by this Office to the Department of Justice for the institution of suits for the recovery of penalties for operating without a license in violation of the act. Penalties were assessed in these cases in amounts ranging from $25 in one case to $3,000 in another, with a total of $6,060.

The final decisions rendered by the Secretary during the year, with their respective grounds and numbers, were as follows: Rejection by the buyer without reasonable cause, 97; failure to deliver without reasonable cause, 53; failure truly and correctly to account, 178; failure to keep adequate records and accounts, 3; false and misleading statements, 3; unfitness to receive license, 5; and fraudulent representations, 2.

There were 38 cases appealed to the Federal courts, several on the ground that the act was unconstitutional. In no case was such contention sustained.

A demurrer attacking the constitutionality of the act was overruled by Judge Bowen of the United States District Court for the Western District of Washington in a suit filed by *George K. Ida, doing business as Vegetable Packers* v. *A. R. White*, No. 211, in July 1937. The constitutionality of the act was upheld also by Judge Woodward, of the United States District Court for the Western District of Illinois, in a suit filed by *O. B. West Co.* v. *Nathan Wilensky*, June 6, 1938.

Of interest to the Department in the adminisration of he Perishable Agricultural Commodities Act are two criminal cases pending in the United States District Court for the Southern District of New York. They are entitled *United States* v. *International Brotherhood of Teamsters, Chauffeurs, Stablemen, and Helpers of America, et al., Local No. 202*, and *United States* v. *Market Truckmen's Association*. These are criminal prosecutions under the antitrust laws for conspiracy to restrain the shipment, sale, transportation, and delivery of produce in interstate commerce except upon terms and conditions dictated by the defendants. Numerous complaints have been received by the Department from shippers who consign fruits and vegetables to commission merchants in New York City for sale on account, protesting against the cartage charges assessed in that market. It is claimed that charges as high as 10 cents per package are assessed for moving packages not over 200 feet. Information from the Department of Justice is that the cases will probably be tried in the late fall or early winter.

PRODUCE AGENCY ACT

(44 Stat. 1355)

At the beginning of the year, there were eight cases pending under this act, and five cases were referred to the Department of Justice. In two of the cases convictions were secured; in one the defendant was placed upon probation for 3 years and in the other the defendant was fined $100 and sentenced to 3 months in jail.

UNITED STATES STANDARD CONTAINER ACTS

(39 Stat. 675 and 45 Stat. 685)

Only one case was initiated alleging violation of the Standard Container Act of 1928. This was the case of *United States* v. *H. R. Lindabury & Sons*, in the United States District Court for the District of New Jersey. This case resulted in pleas of guilty, and fines of $5 each were imposed on the three defendants.

Immediately following the assessment of the fines, the defendants requested instructions from the Department as to what disposition was to be made of the baskets and specifically asked authority to recondition them. This was granted and the cost of supervision and inspection was paid by the defendants. Subsequently, over a period of several weeks, some 41,000 baskets were reconditioned and brought into compliance with the requirements of the act by removing the middle hoops and replacing them with new ones over a form of proper size. The inspection costs were duly paid.

No cases are pending from previous years.

CASES OF INTEREST

In a decision of June 1, 1938, in a suit brought by *Snively Groves, Inc.*, v. *Florida Citrus Commission* (23 F. Supp. 600), the United States District Court for the Northern District of Florida upheld a regulation of the Florida Citrus Fruit Commission establishing, as the standard container for citrus fruits, a container of a capacity of 1⅗ bushels. The court found that the purpose of the regulation was to protect the largest industry of the States and that the regulation was issued as the result of an exhaustive study and research by the State commission as to the advisability and wisdom of adopting a container of standard capacity. The court quoted the following from the decision of the United States District Court for Oregon in *Pacific States Box & Basket Co.* v. *Gelhar* (9 F. Supp. 341):

> It is a matter of general knowledge that enforced standardization of containers is essential to the economic handling, shipping, and selling of horticultural products, for, among other reasons, it prevents fraud and deception in sales, provides the best method of stowage, and eliminates many sizes that complicate the problems of transportation.

In the case of *Polk Co.* v. *Glover* (22 F. Supp. 575), decided February 1, 1938, the United States District Court for the Southern District of Florida upheld a statute of Florida requiring containers of canned citrus fruits and juices produced in that State to have the word "Florida" embossed upon or stamped into the tine of the containers. It was held that the statute did not interfere with interstate commerce.

COMMODITY EXCHANGE ACT

(42 Stat. 998; 49 Stat. 1491; 52 Stat. 205)

There were prepared, for prosecution by the Attorney General, complaints in five alleged violations of the Commodity Exchange Act. In one of these cases, prosecution resulted in fines totalling $1,000.

Assistance was given to the Commodity Exchange Administration in drafting and issuing rules and regulations under the act. Communication was established with the Department of Commerce and the Department of Justice in matters within the jurisdiction of the Commodity Exchange Commission. Representatives of this Office attended hearings and assisted in the preparation of orders with respect to a delivery period after the close of trading in futures in the delivery month, and in connection with limitations on speculative trading in grain.

CASES OF INTEREST

The Supreme Court refused to review three cases in which circuit courts of appeals had sustained the constitutionality of the act during the preceding year.

During the year Cargill, Inc., a large grain firm, filed allegations with the Commodity Exchange Commission that the Chicago Board of Trade had manipulated grain prices by ordering Cargill to reduce its futures position. The Board of Trade answered that it was merely complying with requirements of the act in endeavoring to prevent Cargill from cornering the market. The case was pending before the commission at the close of the year.

Burke & Co., a corporation, Stephen A. Burke, its president, and Hugh S. Gamble, its vice president, were charged in the United States District Court for South Dakota with failure to register as a futures commission merchant and with wrongful use of funds belonging to customers. Gamble pled nolo contendere and was put on probation for 18 months. Burke pled guilty to three counts and, as stated above, was fined $1,000. The case was dismissed as to the corporation because it was bankrupt and no good purpose could be accomplished by prosecution.

PACKERS AND STOCKYARDS ACT

(42 Stat. 159 and 49 Stat. 648)

At the beginning of the fiscal year, there were 149 formal administrative proceedings pending; and there were 276 new proceedings instituted and 17 were reopened. Of the 17 reopened, 13 involved reasonableness of rates and 4 concerned poultry licenses. Final action was taken on 381 of the proceedings and 61 were pending at the close of the year. Of the 276 new proceedings instituted, 62 involved trade practices and reparation; 9 failure to maintain bonds; 17 insolvency; and 188 applications for poultry licenses. Cease-and-desist and suspension orders were issued in 30 cases, suspension orders in 6, reparation orders in 4, orders prescribing reasonable rates and charges in 3, orders granting licenses in 248, orders denying licenses in 39, orders suspending licenses in 3, orders revoking licenses in 4, orders of dismissal in 42, and miscellaneous orders in 2.

In addition, 10 petitions for modification of previous rate orders were received and acted on.

There were 16 convictions for doing business without a license to handle live poultry in interstate commerce, and $1,150 in fines imposed.

St. Louis, Mo., was designated as a live poultry market in an order of the Secretary dated October 4, 1937, effective November 19, 1937.

Examiners and attorneys from the Office were in charge of the cases in which formal hearings were held. In each rate hearing and disciplinary proceeding, an attorney from the Office prosecuted the inquiry or the complaint for the Department.

Following the completion of an extensive hearing involving alleged violations of title II of the act by Swift & Co. (B. A. I. Docket No. 580), an examiner's report was served upon the respondent and the case was argued orally before the Secretary. Thereafter, an order was issued by the Secretary finding the evidence insufficient to sustain some of the charges but requiring the packer to cease and desist from certain practices found to be unfair and unjustly

discriminatory, in violation of the act. This case was of more than ordinary interest and importance, as such fundamental questions were involved as the extension of credit to purchasers, discounts to some purchasers and not to others, and alleged discriminatory practices in regard to the sale, by weight, of certain wrapped or boxed packing-house products. The company has filed an appeal in the Federal circuit court of appeals at Chicago.

In the latter part of the year, a hearing was commenced against Armour & Co., Cudahy Packing Co., Swift & Co., Wilson & Co., and several of their subsidiaries (B. A. I. Docket No. 909), involving alleged violations of various provisions of title II of the act, including combinations and agreements to manipulate prices at which livestock and other articles are purchased and the apportionment of territory in which purchases are made.

CASES OF INTEREST

The Kansas City commission rate case, known as the *Morgan* case, which was first decided by the United States Supreme Court on May 25, 1936 (298 U. S. 468), and in which a second opinion was rendered by that Court on April 25, 1938 (304 U. S. 1), has attracted Nation-wide interest. An inquiry and notice of hearing was issued by a former Secretary for the purpose of determining the reasonableness of the rates and charges of the market agencies engaged in the business of buying and selling livestock on a commission basis at the Kansas City Stockyards. Upon the conclusion of the proceedings before the examiner, the case was argued before Assistant Secretary Tugwell in March 1933. Secretary Wallace signed an order, in June 1933, making a substantial reduction in the rates and charges. The market agencies (about 50 of them who were members of the Kansas City Livestock Exchange) brought suit in the Federal District Court at Kansas City to enjoin the enforcement of the order. A temporary injunction was granted on condition that the market agencies should impound with the court, pending the termination of the litigation, the excess charged above the prescribed rates. Among other allegations, the market agencies pleaded that they had been denied a full hearing, because they had not been permitted to argue the case before the officer who signed the order. On motion of the Government, this allegation was stricken from the bill and the district court later sustained the Secretary's order on its merits. The market agencies then appealed to the Supreme Court, which held that it was error for the lower court to strike out the allegation, and an answer was then made thereto. Subsequently, the case was tried before the district court and depositions of the Secretary and the former Solicitor were read in evidence. That court found that the market agencies had received a full and fair hearing and again sustained the order on its merits. The market agencies appealed to the Supreme Court, which reversed the lower court, without passing upon the merits. The Court held that there was a vital procedural defect in that the market agencies were not given an opportunity to know the claims of the Government and present argument thereon. Following the second decision of the Supreme Court, the district court entered an order directing that the impounded money, amounting to more than $600,000, be returned to the market agencies, and the Government has taken appropriate action to have this phase of the matter reviewed by the Supreme Court when it convenes in the fall.

The procedure adopted by the Secretary, in September 1936, to govern proceedings of this sort provides that there shall be a report by the examiner containing tentative findings of fact and a tentative order, to which the parties may file exceptions and upon which they may make oral argument to the Secretary. Under this procedure, it is believed that the procedural defect found in the Kansas City case will be avoided in the future.

On May 31, 1938, the Supreme Court of the United States delivered an opinion in which it sustained an order of the Secretary prescribing reasonable rates for stockyard services at the Denver Union Stockyards (304 U. S. —). The Secretary's order of February 17, 1937, was entered pursuant to the authority vested in him by the Packers and Stockyards Act. The order had been previously upheld by the Federal district court. This case is of special interest because of its association with a previous case in which the Secretary's order prescribing reasonable rates at the same stockyards was declared invalid by the district court. In the earlier case, the Secretary had excluded from

the rate base the property devoted to an annual livestock show and the trackage adjoining the loading and unloading facilities which were used for the transportation of livestock to and from the stockyards. In that case, the Secretary had also prescribed a yardage charge to be paid by the traders who were engaged in buying and selling livestock for profit in the stockyards. On all of these points, as well as some others, the district court held that the Secretary's order could not be sustained. On account of one uncertain factor in the case, no appeal was taken from the decision of the district court. A new proceeding was therefore instituted, and, in this new case, the Secretary decided these questions in the same manner as before. Both the lower court and the Supreme Court sustained his findings and held the rates to be fair and reasonable.

Several other questions of major importance were decided in this case. There has been much controversy in the field of rate making relative to the necessity of making a special allowance in the rate base to cover what is known as "going-concern value." The Secretary made no special allowance for this item, but found a value for rate purposes which included a consideration of the "going" element. The court held that the evidence did not warrant a finding that the Secretary's order was confiscatory because the Secretary did not add a special allowance for this claimed element of value.

There has been considerable discussion, also, from time to time, regarding the possibility of using, in rate proceedings, the services of land appraisers, who are not local real-estate men. In this case, the evidence with respect to land value was presented on behalf of the Government by an engineer and land appraiser regularly employed by this Department to do that sort of work. While his previous experience had included many years in land-appraisal work for the Interstate Commerce Commission, he had never engaged in the real-estate business in Denver and his experience had never brought him in contact with Denver real estate. The stockyard company attacked his qualifications on the ground that he did not know local conditions. The court held that the evidence showed that his experience rendered him competent and that he used the proper principles in his ascertainment of value.

The reduction in rates effected by the Secretary's order in this case results in a saving of approximately $50,000 annually to those who ship livestock to the Denver Union Stockyards. The stockyard company is now engaged in refunding the excess charges collected, since the Secretary's order was temporarily enjoined by the district court on condition that the stockyard company give a bond guaranteeing that the excess charges would be refunded, if the order should be eventually sustained.

The Secretary, on December 29, 1936, issued an order directing the Great Atlantic & Pacific Tea Co. to cease and desist from the deceptive practice of concealing the true relationship existing between it and any employee while such employee is purchasing meat or meat food products from any meat packer. The case was appealed to the Circuit Court of Appeals for the Third Circuit and was pending at the close of the year.

WILDLIFE CONSERVATION

Cases in which fines are recovered under the wildlife conservation laws, are shown in table 8.

TABLE 8.—*Cases in which fines were recovered*

Law involved	Cases	Fines
	Number	*Dollars*
Migratory Bird Treaty Act	576	12,456.00
Migratory Bird Conservation Act	3	45.00
Migratory Bird Hunting Stamp Act	77	351.50
Bird and Animal Reservation Trespass Act	11	142.00
Lacey Act	10	1,450.00
Upper Mississippi River Wildlife and Fish Refuge Act	5	105.00
Total	682	14,549.50

MIGRATORY BIRD TREATY ACT

(40 Stat. 755)

There were 669 cases under this act referred to the Department of Justice for appropriate action. A total of 730 cases were closed, as follows: 576 convictions, 68 cases dismissed, 38 cases closed without prosecution, 24 defendants adjudged not guilty by juries, 16 cases nolled prossed, 5 no true bill returned, and 3 closed by death. At the close of the year, 263 cases were pending.

Fines imposed total $11,171 and, in addition, $969 in fines were suspended by the courts. Jail sentences were imposed for a total of 2,089 jail days, with 3,325 additional jail days suspended by the courts. There were also imposed probation periods covering a total of 86 years and 2 months.

Several fines in these cases are worthy of note. In California, there were two fines of $300 each, with jail sentences of 30 and 60 days; one of $500 in Maryland, with commitment in default of payment; and in eight cases in Illinois the fines were $100 each.

MIGRATORY BIRD CONSERVATION ACT

(45 Stat. 1222)

There were 11 new cases under this act submitted to the Department of Justice for appropriate action. Ten cases were closed with convictions in each instance; three cases yielded $45 in fines; two cases resulted in jail sentences of 30 days each; in one case the defendant was placed on probation for two years; and in four cases the defendants were placed on probation for 6 months each. There were four cases pending at the close of the year.

MIGRATORY BIRD HUNTING STAMP ACT

(48 Stat. 451)

There were 74 new cases under this act submitted to the Department of Justice for appropriate action. One hundred and one cases were closed, in 77 of which convictions were obtained. Seventy cases yielded fines totaling $351.50 and, in addition, there was a total of $50 in fines suspended by the courts. Seven cases resulted in the defendants being placed on probation for periods of from 5 minutes to 2 years. Two cases resulted in jail sentences totaling 61 days, of which 60 days were suspended. Four cases were nolle prossed, 12 were dismissed, 3 were closed without prosecution, in 3 the defendants were adjudged not guilty, 1 case was terminated by the death of the defendant, and in 1 case the grand jury returned no bill. Forty-four cases were pending at the close of the year.

BIRD AND ANIMAL RESERVATION TRESPASS ACT

(Sec. 84 of the Penal Code)

There were 32 new cases under this act submitted to the Department of Justice for appropriate action. In 14 cases, there were convictions, with fines totaling $142, and three of the defendants were placed on probation for a period of 6 months each. There were 21 cases pending at the close of the fiscal year.

LACEY ACT—REGULATING INTERSTATE COMMERCE IN WILD ANIMALS

(35 Stat. 1139; 49 Stat. 380)

There were 11 cases under this act referred to the Department of Justice. Fifteen cases were closed, 10 of which resulted in convictions yielding $1,450 in fines, jail sentences of 1 year, 6 months, and 1 day, of which 6 months were suspended by the court, and a probationary period of 2 years. Four cases were dismissed, and, in one case, the defendant was adjudged not guilty. There were four cases pending at the close of the year.

UPPER MISSISSIPPI RIVER WILDLIFE AND FISH REFUGE ACT

(43 Stat. 650)

There were 12 new cases under this act reported to the Department of Justice for appropriate action. Twelve cases were disposed of as follows: Nine convictions, five yielding $105 in fines, two resulting in 30-day jail sentences, and

two resulting in the defendants being placed on probation for 1 year and 6 months; in two cases, no true bills were returned; and 1 case was nolle prossed. There were eight cases pending at the close of the year.

CASES OF INTEREST

In the case of *United States* v. *Henry Otley et al.*, involving the riparian rights of owners of lands abutting on Lake Malheur, about 2½ months were spent by attorneys of this Office in collecting evidence for the trial, which was originally set for July but was subsequently postponed until the September term of court, owing to the death of the attorney for the defendants.

The case of *Cerritos Gun Club et al* v. *Pierson M. Hall et al.*, 96 F. (2d) 620, arose on an appeal to the United States Circuit Court of Appeals, Ninth Circuit, from a decision of the District Court of the United States for the Southern District of California, sustaining the legality of the baiting regulation promulgated pursuant to the Migratory Bird Treaty Act. The district court entered a decree dismissing, without leave to amend, the bill of appellants, a membership corporation and three other corporations, owners of land in southern California which had been improved for migratory wild-fowl hunting purposes. The appellants sought equitable relief for the protection of the value of their investments by enjoining appellees, who were Federal officers, from prosecuting them for luring migratory game birds to their properties by the use of grain, so that the birds could be shot by the members of the clubs. The regulation prohibits the baiting of birds by means, directly or indirectly, of scattering grain to lure them to the hunting areas. The appellants in this case, among a large number of hunting enterprises located in California, make it a business to maintain lands upon which habitats are established for migratory waterfowl hunting. Accommodations are provided for members and opportunity to hunt is made possible only by luring and keeping the game by scattering over the premises grain on which the birds can subsist.

The appellate court, in its decision of April 15, 1938, affirmed the decision of the district court, which upheld the validity of the regulation, upon the ground that it was authorized by the terms of the treaty between the United States and Great Britain providing for shortening the season for hunting. The court also held that the act of Congress, passed in furtherance of the treaty, which authorizes the Secretary to make regulations subject to the approval of the President, was not an unlawful delegation of power, and that the regulation in question did not lack the degree of definiteness necessary to describe a penal offense.

The case of *Fred W. Schwarz* v. *Henry A. Wallace, et al* is a suit in the United States District Court for the District of South Dakota. It arose out of the construction of dikes and dams on the Little White River, within the LaCreek Migratory Water Fowl Refuge in South Dakota. The complainant is the owner of a hydroelectric plant on the river, about 80 miles downstream from the refuge. He contends that the operations of his plant have been impaired because these dikes and dams divert the water from the plant. He seeks to enjoin permanently the defendants from, in any manner, preventing the water of the Little White River and its tributaries from flowing down the main channel thereof and from proceeding with further construction of dikes and dams. He asks for damages in the sum of $6,000 and costs. The hearing on the Government's motion to dismiss the bill of complaint has been extended by stipulation between the parties from time to time, in order to permit the continuance of negotiations, which began shortly after suit was filed, to effect a compromise settlement whereby the complaint will be guaranteed a sufficient amount of water power to operate his plant on a profitable basis in lieu of the money damages claimed. The Department has already approved the terms of a proposed agreement for settlement, and it seems probable that the agreement will meet with the approval of the other interested parties, thereby making possible the settlement of this matter out of court.

The case of *United States* v. *A. C. MacMillan et al.* is a suit in the District Court of the United States for the District of Minnesota. It grew out of the defendants' alleged unlawful destruction of dikes, ditches, dams, and other water-control structures constructed by the Department in the Mud Lake Migratory Water Fowl Refuge in Minnesota. The Government is seeking to enjoin the defendants from further destruction of these water control structures. The court granted a temporary restraining order on May 14, 1938, on the basis of the affidavits that were submitted in support of the allegations contained in the bill for injunction. The case appears to be at issue now on the question of whether the Government is entitled to maintain these water

control structures in the drainage ditches passing through and over Government lands within the boundaries of said refuge free from interference by the defendants. It is contended by the defendants that such structures affect the successful operation of a certain drainage canal in which they are interested.

In connection with this matter, the Department of Justice was requested to investigate the alleged leadership of A. C. MacMillan and Verner Nelson, co-defendants in the above-entitled cause, in the mob which damaged property of the United States on the refuge in question. The purpose of the investigation is to determine whether there is evidence sufficient to warrant criminal prosecution for destruction of Government property in violation of section 10 of the Migratory Bird Conservation Act.

The cases of *Witt K. Cochrane* v. *United States* and *William K. Fellows* v. *United States*, 92 F. (2d) 623, arose on appeals to the United States Circuit Court of Appeals, Seventh Circuit, from judgments of the District Court of the United States for the Southern District of Illinois, in which the appellants were prosecuted and convicted on charges of hunting wild ducks by means of bait in the form of corn and rye, contrary to the provisions of the Migratory Bird Treaty Act and the regulations promulgated thereunder. The appellate court, in its decision of October 4, 1937, affirming the judgments of the district court, held that the power of Congress under the Migratory Bird Treaty to deprive hunters of any open season carries with it the power to provide for a limited open season for limited purposes only; that Congress may lawfully legislate under the commerce clause of the Constitution as to game, nongame, and insectivorous birds which migrate with the changing seasons; and that the regulation does not prohibit the feeding of birds, but rather the feeding of them in such a manner as to lure them close to a blind wherein hunters are lodged.

With reference to the power of Congress over migratory birds under the commerce clause of the Constitution, the court said:

> It is impossible to deal with migratory birds on the basis of their being property of the state or of the state's having an exclusive property interest in them. Ordinarily an attribute of property and of property rights is possession. It is obviously impossible to reduce the property rights in migratory birds to possession. Moreover, it is equally impossible even to identify the birds after they have passed from one state into another and returned to the state where they were hatched. It is unbelievable that the framers of the Constitution intended to leave this form of valuable property, which did not vest in the individual and which could not be controlled by the state, unprotected and fated to total destruction. It is not a matter of sentiment but of common sense.

The case of *United States* v. *R. B. Hornor et al.* was a criminal prosecution in the District Court of the United States for the Northern District of Texas upon an indictment charging the defendants with conspiracy to violate the provisions of the Migratory Bird Treaty Act. Upon pleas of guilty, the court imposed the following sentences: Defendant Hornor, 13 months in the Federal penitentiary at Leavenworth, Kans.; defendants Page and Sparks, 13 months each in Leavenworth and on probation for a period of 3 years; two other defendants, 30 days each in Tarrant County jail and on probation for a period of 3 years; and the sixth defendant, 30 days in Tarrant County jail.

This case is of unusual interest in that it was the prosecution for conspiracy to violate the Migratory Bird Treaty Act. The principal defendant, "Jack" Hornor, was the proprietor of a night club known as "Gingham Inn," located on Jacksboro Highway, about 8 miles from Fort Worth, Tex. Hornor catered to the wealthy and prominent people of the locality and frequently had as guests some of the "who's who" of the Nation. Persons less thrifty were discouraged by doubling and trebling prices, padding checks, discourteous treatment, etc. For 5 years the place was operated without interference, consuming more wildlife than a sizable game refuge could produce and more than the legitimate hunters of several counties would kill during the hunting season.

UNITED STATES WAREHOUSE ACT

(39 Stat. 486)

Amended regulations were considered as to their legal sufficiency.

UNITED STATES GRAIN STANDARDS ACT

(39 Stat. 498)

An interesting situation developed in New York on account of the refusal of a certain firm of vessel agents to allow inspectors to board a vessel for the inspection of a cargo of grain from Argentina. Permission to do this was

refused because the inspectors would not sign an agreement by which they would assume all risk of bodily injury while aboard the vessel, even though the injury might be caused by the negligence of the ship owner or his agents. In anticipation of the arrival of another vessel from Argentina to be handled by these same agents, the matter was referred to the Department of Justice, with a request that appropriate action be taken. The United States Attorney's office cooperated fully with the Department's local representative, with the result that the inspectors were permitted to board the vessel and inspect the grain without having to sign the agreement.

FISCAL DIVISION

In addition to the contracts and leases listed in table 2, there were examined, as to sufficiency of form and execution, numerous leases and contracts prepared by the various Bureaus and by individuals and corporations. These included 1,631 cooperative agreements between the Bureaus of the Department and State experiment stations, corporations, and individuals, covering experimental work of various kinds. Contracts covering aerial survey work were among the most important prepared and executed during the year, there being 43 in number, carrying a total of $1,581,026.52. Also, contracts for construction work and for supplies represented a very considerable part of the work, one contract alone calling for the expenditure of $957,500 for the construction of a laboratory building at Abingdon, Va., for the Bureau of Public Roads. The grand total of money involved in these contracts, including leases, is $9,092,767.56.

There were also prepared 760 renewals and 56 terminations of leases and contracts, and there were prepared or examined 74 bonds covering Department employees, including disbursing and assistant disbursing officers, collection and assistant collection officers, and market administrators under the Agricultural Adjustment Administration. There were examined for sufficiency of execution 210 contract-performance bonds, 9 annual bid bonds, 48 bid bonds, 11 bonds to protect the Government against infringement of patents, 8 bonds to insure the proper accounting for fees collected in connection with the inspection of hay and soybeans, and 91 bonds of indemnity furnished on account of irregularities in the handling of participation trust certificates under the cotton program. Three bonds were prepared to cover advances of funds under the two acts of June 3, 1902, and the Subsistence Expense Act of 1926, and six were prepared to cover advances for miscellaneous expenses of employees under the act of June 3, 1902. It was necessary, in numerous instances, to secure, from the home offices of surety companies, ratification of the acts of their agents in executing bonds without authority, as disclosed by the records of the Treasury Department. Also, it became the duty of this Office to make demands upon certain surety companies for settlements under bonds growing out of shortages in accounts.

In furtherance of the national program under the Farm Security Administration and the Federal Crop Insurance Corporation, several new forms were prepared, notably a bond designed to protect clients of the Farm Security Administration as well as the Government and a schedule form to cover the numerous employees and officers of the Federal Crop Insurance Corporation.

In connection with the work of the Agricultural Adjustment Administration having to do with county agricultural conservation associations, 2,053 bonds covering treasurers of such associations, carrying total penalties of $3,377,265, were examined for sufficiency of execution.

From time to time, the Treasury Department furnishes the Office with a list of corporations which have filed petitions for reorganization under section 77–B of the Bankruptcy Act, as amended. A copy of such list is transmitted to the bureaus with a request that if they are indebted to, or have claims against, any of the corporations listed, such information should be furnished to this Office. Assistance was rendered in the preparation of proofs of claims which the bureaus filed with the clerks of the proper courts in order properly to protect the interests of the Government.

This Office supervised the preparation of the codification of the documents regarded by this Department as having general applicability and legal effect, as required by section 11 of the Federal Register Act, as amended by the act of June 19, 1937 (50 Stat. 304). This voluminous work has been completed and forwarded to the Codification Board.

As a result of motor-vehicle accidents involving Department of Agriculture drivers, this Office examined 160 cases. Where the evidence indicated a lack

of negligence on the part of the Department's drivers and restitution appeared to be due the United States, demand was made for reimbursements for the damages sustained. In many instances, collections were effected by this Office. In those cases where collections were not made, they were referred to the Department of Justice for appropriate action.

Twenty-one cases dealing with overpayment of salary to departmental employees were considered and, in many instances, the amount of the overpayment was recovered. In those instances where recoveries were not secured by this Office, the cases were referred to the Comptroller General for appropriate action. A few cases involving irregular administrative practices and general misconduct on the part of departmental employees were also considered. In cases where the facts warranted such action, the cases were referred to the Department of Justice with the recommendation that criminal proceedings be instituted against the employees.

Numerous claims for money due to the United States for inspection fees, etc., were handled by the Office. A number of bills and acts for the relief of private persons, which had been referred to the Department by Congress for consideration and report, were examined and reported upon.

Various departmental employees, arrested for traffic violations while acting within the scope of their employment, were represented at their hearings by attorneys from this Office. Assistance was also rendered by the Office in a number of civil actions involving departmental employees which arose as a result of official activities.

The bid work of the Department presented many technical and intricate problems and required the Office to devote a great amount of time to this phase of the Department's work.

A complete indexed file of the decisions of the Comptroller General is maintained and kept up to date. Its accessibility to all the attorneys of the Solicitor's Office and to the bureaus of the Department has been of great assistance and importance in the efficient handling of the legal and administrative problems of the Department. The 452 decisions of the Comptroller General addressed to the Secretary of Agriculture during the year were received, filed, and indexed. Like decisions addressed to other Departments, 233 in number, were also indexed and filed.

The attempt to keep on file all current regulations governing the Procurement Division procedure and other interdepartmental work has been continued with increased success.

The continuance of much of the emergency activity and the intricate provisions of the many appropriation acts, etc., have greatly increased the work of the Office. The many decisions of the courts and of the Government departments and independent establishments have also added to the work of the Office.

CLAIMS

(42 Stat. 1066; 50 Stat. 319)

There were on hand for consideration, at the begininng of the year, 180 claims, in a total amount of $36,480.46. These claims, which were based upon damage to privately owned property allegedly caused by the negligence of departmental employees, had been filed with the various bureaus of the Department and later referred to this Office for legal recommendation. There were 965 additional claims in the total amount of $169,373.85 submitted to this Office during the year. Of these, 533 claims were filed under the so-called Small Claims Act of December 28, 1922, and 432 under the so-called Civilian Conservation Corps Act (sec. 16) of June 28, 1937. At the close of the year, 195 of the claims mentioned above were pending.

Final disposition was made of 950 claims in the total amount of $155,726.82, as follows: 458 claims were disallowed entirely, representing the amount claimed of $111,080.30; 328 claims were allowed as claimed in an amount aggregating $12,832.19; 164 cases, involving the sum of $31,814.33, were recommended for partial payment in amounts totaling $10,646.42.

Seventy-nine additional appeals in claims cases, totaling $21,044.18, were referred to this Office, which, with the 17 on hand totaling $8,611.41, made a total of 96 cases of this nature, aggregating $29,655.59. Of this number, 71 cases have been reexamined, and 15 have been readjusted and approved for payment in the amount of $1,544.81. At the close of the year, 25 appeals were pending.

The majority of the cases arose out of automobile collisions. The remaining cases involved negligence in connection with poison, location of boundaries,

fires, landslides, dams, trespassing animals, etc. The applicable State law has been consulted in connection with each claim and decisions have been made only after complete data regarding the loss or damage have been assembled and examined.

The employment of large numbers of Civilian Conservation Corps members on projects of the Department and the attendant increase in the number of motor vehicles and other necessary paraphernalia resulted in a tremendous increase in the number of claims based on alleged negligence of employees of the Department. Moreover, the act of June 28, 1937, mentioned above, providing as it does for consideration of claims for necessary medical and hospital expenses resulting from personal injuries, has increased the legal problems in connection with the claims work of the Office. Prior to June 28, 1937, this Department had no authority to consider any claim on account of personal injury, so that one so injured had no remedy other than the enactment of a private bill for relief by the Congress. The Department could consider and recommend only meritorious claims not in excess of $1,000 on account of loss of or damage to privately owned property, under authority of the act of December 28, 1922 (42 Stat. 1066). After favorable recommendation by the Department, such claims are required by this act to be submitted to the Bureau of the Budget, and thereafter they must await action by the Congress in connection with a deficiency bill. Under this procedure, it frequently happens that more than a year elapses between the date of the negligent act and the reimbursement of the claimant.

Since a majority of the personal-injury claims submitted to the Department are based on the alleged negligence of members of the Civilian Conservation Corps, the situation mentioned above has been remedied to a substantial extent by the provisions of section 16 of the act of June 28, 1937 (50 Stat. 319), which provides that the Director of the Civilian Conservation Corps and, under his supervision, the heads of the various departments and agencies may consider and pay out of funds appropriated for the purposes of that act, without reference to any other agency of the Government, claims on account of damage to property and also claims accruing on account of personal injuries, provided that the amount claimed is limited to necessary medical and hospital expenses. Claims in excess of $500 may not be considered and paid under authority of this act. However, the authority under the new legislation is in addition to that conferred by the act of December 28, 1922, mentioned above, rather than in lieu thereof.

The Office also handled six claims under the act of January 31, 1931 (46 Stat. 1052), and seven claims under the act of May 27, 1930 (46 Stat. 387).

PATENTS

Two hundred and twenty-two applications for Letters Patent, on inventions made by employees of the Department, covering a wide field of inventions, were prosecuted, an increase of 34 over the preceding year. Of these, there were 77 terminated, as follows: 48 were patented, 28 were rejected, and 1 was abandoned. One hundred and forty-five such patent applications, prepared and filed through this Office, are now pending before the Patent Office.

One patent interference proceeding between the application for Letters Patent by an employee of this Department and an application filed by an outside party was handled.

The Department was the recipient of several patents from outside sources which were dedicated to the public. These patents related to (1) field wagon and unloading apparatus, No. 1673466, dated June 12, 1938; (2) art of agriculture, No. 1667428, dated April 24, 1928; (3) harvesting machine, No. 1731821, dated October 15, 1929.

CASES OF INTEREST

The patent interference of *Euclid W. Bousquet* v. *Lloyd E. Smith*, a Department employee, covers the question of priority to an invention commonly known as phenthiazine, which relates to insecticides that are water-insoluble organic compounds, having generally the property of being toxic to chewing insects. This compound, while not injurious to man, as in the case of lead arsenate, therefore has value as an insecticide. This case is now awaiting the decision of the Board of Appeals, having been presented by printed brief and oral argument.

United States Patent No. 2105688, entitled "Mounted Plant Specimens and Method of Mounting the Same," was obtained by this Office for a Department

employee who, prior to his employment in the Department, had filed an application privately. When the case came to this Office, it was on final rejection, and the Office had about a week to consider and handle the same. However, before the merits of the case could be prosecuted before the Patent Office, the revocation of the power of attorney to private counsel and a new power of attorney had to be prepared; a request from the Secretary of Agriculture to the Commissioner of Patents to designate the application as a no-fee case, and a dedicatory amendment signed by the applicant, and, finally, a traverse filed for purposes of appeal, had to be drawn. However, the claims presented by this Office were allowed on the argument submitted, and no appeal was necessary. Accordingly, this patent was granted on January 18, 1938.

TITLE DIVISION

The legal work incidental to the land acquisition programs of the Department, requiring title work by this Office, was extensively increased by the consolidation of the Resettlement Administration activities with those heretofore administered by the Department and by additional responsibilities resulting from the title work incidental to the administration of titles I and III of the Bankhead-Jones Farm Tenant Act (50 Stat. 522), and of a number of less pretentious statutes authorizing exchanges and acquisitions of lands in designated areas. The work has progressed satisfactorily, with all submissions being currently considered.

Throughout the year, the National Forest Reservation Commission, created by the Weeks Forestry Act of March 1, 1911 (36 Stat. 961), and also functioning under the provisions of the Clarke-McNary Act of June 7, 1924 (43 Stat. 653), authorized the acquisition of 2,395 offerings in 26 States and in Puerto Rico, aggregating 800,113 acres at a cost of $2,712,761.

The Migratory Bird Conservation Commission, created by the act of February 18, 1929 (45 Stat. 1222), and functioning under the Bureau of Biological Survey program, has authorized during the year the acquisition of 145 offerings in 21 States, aggregating 15,440 acres at a cost of $314,581.

Pursuant to the acts cited, the Office considered and reported on 6,733 cases involving a total of 2,150,000 acres of land, and has closed, by direct purchase and through condemnation proceedings, 4,756 title cases involving a total of 1,847,397 acres, having approved payments therefor totaling $5,791,430.61.

MARKET STABILIZATION DIVISION

The Office continued unabated its work on marketing agreement and order programs, under the Agricultural Marketing Agreement Act of 1937, as amended, putting into effect a number of marketing agreements and orders, about half of which pertained to milk and its products. A few marketing agreement and order programs were terminated or became inoperative. These included the Florida citrus marketing agreement and order, the California deciduous-tree-fruits marketing agreement and order, the gum-turpentine and gum-rosin marketing agreement and license, the Colorado vegetables-marketing agreement and license, the Detroit milk license, the Richmond milk license, and the alcoholic-beverages importing-industry marketing agreement and license. Continuous legal attention was given to the promulgation, administration, and termination or suspension of these basic programs.

Almost a hundred hearings were held on marketing agreements and orders, and these hearings were presided over by attorneys from the Office. Many necessary notices, affidavits, and other legal documents were prepared, and 18,839 pages of testimony were taken, reviewed, and digested. The Office was called on to draft proposed marketing agreements and orders and amendments to existing marketing agreements and orders; also prorate, grade, and size orders, under the applicable marketing agreements and orders; exemption orders, orders selecting control committees, State advisory committees, growers' committees, control boards, and other agencies, under marketing agreements and orders; designations, amendments to designations, and terminations of designations of market administrators; designations of agents under marketing agreements and orders under surplus-removal programs; orders directing that referenda be conducted; and orders approving budgets and fixing current expenses of control committees. Many findings of fact of the Secretary of Agriculture under surplus-commodity removal and diversion programs were drafted, as well as agreements, contracts, and amendments with surplus and indemnity associations established pursuant to section 32 of the act of August 24, 1935 (49 Stat.

750), as amended. Instruments relative to the termination and suspension of marketing agreements, orders, and licenses were also prepared.

A number of orders were prepared, approving the action of control committees and the procedure of such committees under marketing agreements and orders. Three orders were prepared with respect to bonds of milk-market administrators. Continued legal assistance was given to the Federal Surplus Commodities Corporation in the general drafting and preparation of numerous documents, agreements, contracts, orders, correspondence, bylaws, and other corporate procedure, and in reviewing documents for approval. There were in effect 62 commodity purchase and removal programs relative to which legal assistance was rendered, and all legal documents were prepared in connection therewith.

Rules and regulations were drafted for the mediation and arbitration of disputes relative to the handling of milk and its products under section 3 of the Agricultural Marketing Agreement Act of 1937, as amended.

Petitions by handlers under section 8c (15) of the act of May 12, 1933, as amended by the act of August 24, 1935, and reenacted by section 1 (e) of the Agricultural Marketing Agreement Act of 1937, continued to appear. Forty-four hearings were held, which were presided over by attorneys of the office, and testimony was reviewed and digested.

The Office assisted the Department of Justice in the handling of extensive litigation concerning the regulation of the handling of milk and its products under the Agricultural Marketing Agreement Act of 1937. To enforce various milk orders in New England, 38 suits were filed in the lower Federal courts of Vermont and Massachusetts. Thereafter, 25 contempt proceedings were filed to enforce temporary injunctions issued on behalf of the United States and the Secretary of Agriculture, 22 of which were dismissed after compliance or without prejudice, and 3 of which resulted in fines. A more detailed description of these milk cases is given later in the report. Twenty-two cases, chiefly involving citrus orders, which had been commenced either during the year or before the beginning of the year, were successfully closed.

There are now pending the following cases, other than the litigation relating to the Boston and Fall River milk orders: *Beranek* v. *Wallace*, a suit to restrain the enforcement of the La Porte, Ind., Milk Order No. 20, in the Northern District of Indiana; *United States* v. *Cherokee Citrus Co., Inc.*, a suit to restrain the defendant from violating the California-Arizona Citrus Order No. 2, filed in the Southern District of California; *United States* v. *Whittenburg*, a suit to restrain enforcement of the Texas Citrus Order No. 15, filed in the Southern District of Texas and now in the course of appeal in the Circuit Court of Appeals for the Fifth Circuit; *United States* v. *Withers Bros., Ltd.*, a suit to restrain the defendant from violating the California-Arizona Citrus Order No. 2, filed in the Southern District of California.

CASES OF INTEREST

The entire year was notable, from the point of view of litigation, in that there was a thoroughgoing attempt to establish the constitutionality of the regulation of interstate commerce in milk, as provided in the Agricultural Marketing Agreement Act of 1937, as amended. In October 1937, 30 bills of complaint were filed in the United States District Court for the District of Massachusetts in an effort to restrain violations of Milk Order No. 4, as amended. Order No. 4, regulating the handling of milk in the greater Boston area, was first issued by the Secretary of Agriculture on February 7, 1936. It was thereafter amended on August 1, 1937.

The original order had given rise to the case of *United States* v. *David Buttrick Co., et al.* (15 F. Supp. 655). The *Buttrick case* proved to be a means of testing whether *United States* v. *Butler* (297 U. S. 1), which had invalidated certain provisions of the original Agricultural Adjustment Act, had also affected the marketing agreement and order provisions. An appeal was taken from the decision of the United States District Court for the District of Massachusetts, which had held that the Supreme Court of the United States had invalidated the entire act, to the Circuit Court of Appeals for the First Circuit. On June 16, 1937, the circuit court of appeals rendered an opinion (91 F. (2d) 66) vacating the judgment of the district court and remanding the case to that court for trial on the ground that the marketing provisions of the act were separable from those provisions which had been invalidated by the Supreme Court. The defendants then petitioned the United States Supreme Court for a writ of certiorari, which was denied.

The litigation which was instituted by the Government in October 1937 brought squarely before the court the constitutionality of the marketing agreement and order provisions of the Agricultural Marketing Agreement Act of 1937. The United States District Court for the District of Massachusetts, on November 19, 1937, ruled that the Agricultural Marketing Agreement Act of 1937 and Order No. 4, as amended, were valid and constitutional, and issued temporary injunctions as to each of the defendants. Seven of the defendants obtained writs of supersedeas from Judge Bingham, of the Circuit Court of Appeals for the First Circuit, which commanded the payment of equalization funds into the registry of the district court, pending the determination of the appeal, and the payment of certain other moneys, as required under Order No. 4, as amended, to the market administrator. On April 29, 1938, the appeals from the decrees of the district court granting the temporary injunctions were argued before the circuit court of appeals. On June 24, 1938, the appellate court rendered a per curiam decision, ordering that the temporary injunctions continue in force until a final determination of the cases on their merits. It was ordered, however, that the moneys involved in the appeals should be paid into the registry of the district court in a manner equivalent to that provided by the writs of supersedeas. The hearings before a master appointed by the district court, on the application for a permanent injunction, were concluded on April 28, 1938. The Boston milk cases, the leading one of which, in the circuit court of appeals, bore the title, *United States* v. *H. P. Hood & Sons, Inc., et al.*, will undoubtedly furnish a basis for an authoritative adjudication as to the constitutionality of the marketing agreement and order program by the Supreme Court of the United States.

Edwards v. *United States*, 91 F. (2d) 767, a most important case, was concluded during the course of the year. The United States filed a bill seeking to restrain and enjoin the defendant from shipping oranges in violation of the California-Arizona citrus order. The United States District Court for the Southern District of California granted a permanent injunction and the defendants appealed to the United States Court of Appeals for the Ninth Circuit, attacking the constitutionality of the act and the order. On July 22, 1937, the circuit court of appeals sustained the validity of the controlling legislation and the citrus order.

In the case of *Hudson-Duncan & Co.* v. *Wallace*, 21 F. Supp. 295, an appeal was perfected from the decision of the United States District Court for the District of Oregon rendered on May 17, 1937, holding a walnut order to be invalid. Argument was heard on April 28, 1938, by the United States Circuit Court of Appeals for the Ninth Circuit, but no decision had been rendered at the close of the fiscal year.

The constitutionality of provisions, other than milk provisions, of the Agricultural Marketing Agreement Act of 1937 were sustained again during the course of the year in *United States* v. *Whittenburg*, in which the United States District Court for the Southern District of Texas granted a permanent injunction in a suit to restrain violation of Texas Citrus Order No. 15. The court, in a written opinion, upheld the constitutionality of the act and the order of the Secretary and granted a permanent injunction. The case has been appealed to the Circuit Court of Appeals for the Fifth Circuit.

AGRICULTURAL ADJUSTMENT DIVISION

The legal work incident to the formulation and administration of the following programs was handled by the Office: The 1937 and 1938 agricultural conservation programs; the 1937 and 1938 range conservation programs; the 1937 and 1938 naval stores programs, under section 8 of the Soil Conservation and Domestic Allotment Act; the sugar-beet and sugarcane programs under title III, and the quota control program under title II, of the Sugar Act of 1937; the allotments for wheat and cotton, and the marketing quotas for cotton and tobacco, under the Agricultural Adjustment Act of 1938; the Federal wheat-crop-insurance program, providing insurance beginning with the wheat crop planted in the fall of 1938; the 1937 cotton-price-adjustment payment plan; and the liquidation, under the Supplemental Appropriation Act, fiscal year 1936, of the 1933 (1933 applicable only to cotton), 1934, and 1935 crop-adjustment programs for wheat, cotton, rye, corn-hogs, tobacco, sugar, peanuts, etc., formulated under the Agricultural Adjustment Act of May 12, 1933, as amended, contracts with respect to which were invalidated by the Supreme Court in the case of *United States* v. *Butler*, 297 U. S. 1.

In connection with the work above described, approximately 3,500 documents and memoranda were written, or assistance was given to various administrative

officials in the preparation thereof. These included general determinations of the Secretary of Agriculture, and amendments thereto; sugar regulations; orders of the Secretary of Agriculture; Federal Crop Insurance Corporation regulations and amendments; bulletins, supplements, and amendments; forms and amendments; proclamations; sets of instructions; and formal documents of various other types.

A close liaison has been maintained with, and assistance has been rendered to, the Department of Justice and the Treasury Department in connection with tax questions arising out of the invalidation of the processing-tax provisions of the Agricultural Adjustment Act of 1933 and in connection with litigation arising out of the operation of the Bankhead Cotton Control Act and the Kerr-Smith Tobacco Control Act, or under the tax-refund provisions of titles III, IV, and VII of the Revenue Act of 1936. Considerable detailed work was also done with respect to investigations and prosecutions of producers for violations of law, in connection with both the old and the new programs.

Much detailed work was done incident to the preparation and formulation of the marketing-quota programs under title III of the Agricultural Adjustment Act of 1938, and also with regard to the Federal Crop Insurance Act, necessitating the preparation of proclamations, regulations, contracts, forms, and instructions.

LAND POLICY DIVISION

Work was continued upon the standard State soil conservation districts law and the program to have it adopted in the various States. Laws more or less similar to the standard act were adopted at the 1938 sessions of the California, Mississippi, Virginia, and Louisiana Legislatures, making a total of 26 States which have thus far adopted such legislation. A districts law was also passed by the New York Legislature, but the bill was vetoed by the Governor. Written opinions were issued adapting the standard act to the constitutional and organization requirements of 9 States, and discussing the constitutional and other legal problems presented by the districts laws which had been enacted in 12 States. Similar work is in progress for the remaining States where such laws either have not been enacted or have not yet been analyzed. In the case of several State districts laws, where analysis of the statute pointed to constitutional and statutory defects, or indicated a failure to conform to basic departmental policy, the office has assisted in the drafting of proposed amendatory legislation.

Attorneys of the Office have been called upon to attend conferences with State legislative and administrative officials in connection with the acts passed this year, prior to their enactment, and also in connection with soil conservation district bills that were being considered in other States, including Ohio, Idaho, and Texas. Conferences were also held with representatives of the offices of the State attorneys general and other interested State agencies in the States which had adopted State soil conservation legislation, in which the legal problems presented by such laws were discussed.

Most of the States which adopted districts laws in 1937 have begun to function under those laws. As of June 15, 66 districts, including a total of approximately 35,546,629 acres, had been created in 16 States. The organization of additional districts in these and almost all other States having districts laws is under way, and there are being prepared, for suggested use by the States, standard rules and regulations, with forms applicable thereto, governing the procedures for the organization of districts and the conduct of hearings, referenda, and elections therein, and forms submitted by various State committees have been commented on. The organization and administration of these districts have given rise to numerous additional legal problems, concerning such matters as membership on the State committee, determination of district boundaries, due notice, exclusion and addition of areas to existing districts, availability of State appropriations, property requirements for voters, qualifications of district supervisors, delegations of authority, and cooperative agreements between the district and farmers therein. These have been discussed in written opinions, in conferences with the offices of the respective State attorneys general, and in the considerable correspondence with State and district officials which has been prepared or reviewed in the Office.

Another exhaustive set of legal problems has been raised in connection with the cooperation which the Soil Conservation Service is extending to soil-conservation districts. As of June 30, the Soil Conservation Service had executed, for the Secretary, memoranda of understanding with 34 districts in 9 States, providing for the furnishing of technical and clerical assistance. The Office

assisted in drafting the standard form of memorandum of understanding extending this type of assistance, as well as the procedures for determining the conditions under which it will be made available. Similarly, standard forms of supplemental memoranda of understanding have been drawn up, providing for the furnishing to districts of Soil Conservation Service equipment, and materials, with relevant procedures and forms. All such memoranda must be approved, as to legal validity, by the Office, prior to execution by the Secretary, and any defects in the necessary papers accompanying them are indicated. In addition, the Office has given legal advice in connection with the Department's renewing its cooperation with nine Texas county wind-erosion districts.

The legal problems involved in extending other types of assistance to districts, such as W. P. A. labor, additional demonstration work, and assistance under the water-facilities program, have been canvassed, as well as the problems raised by possible district cooperation with other Federal bureaus, such as the Forest Service and the Division of Grazing of the Department of the Interior. In connection with this latter problem, considerable advice has been given, both orally and in writing, with respect to the legal restrictions underlying the handling of lands in Federal ownership.

At the request of the Office of Land Use Coordination, four separate studies are now in preparation which are applicable generally to the Department's entire conservation program. The first involves a survey and discussion of the problem of compensation to State and local governmental subdivisions for loss of taxes due to Federal ownership of land and its consequent removal from the local tax base, and will culminate in the drafting of legislation embodying the Department's recommendations on the subject. This study concerns the programs of the Forest Service, Bureau of Agricultural Economics, Bureau of Biological Survey, Soil Conservation Service, and Farm Security Administration, and the water-facilities program, all of which involve Federal ownership or possible Federal ownership of large areas of land. The second study involves an exhaustive discussion of the possibility of bringing private forests under governmental regulation by some means other than purchase, and the preparation of alternative drafts of legislation for that purpose. The third study involves a survey of the water laws of the 17 arid and semi-arid States in the West. This survey will serve as the basis for putting into operation the water-facilities program, which was authorized by the last Congress as a result of a recommendation made by the President's Great Plains Committee, and will also serve as the basis for possible departmental recommendations to the various States for changes or modifications in their respective water laws in the interest of a sound, long-range, water conservation, and land use program. The fourth study involves a detailed examination and analysis of the Department's procedure for acquiring title to land and a comparison of that procedure with the procedures of other Federal departments, for the purpose of suggesting specific means for expediting title clearance and reducing its cost. Drafts of legislation necessary to accomplish this result will also be prepared.

The Office has continued its study of rural-zoning and State-planning legislation in the several States. This study is being carried on for the Land Policy Committee, in cooperation with the National Resources Committee, the Bureau of Agricultural Economics, and the Farm Security Administration.

Legislative reports have been prepared on a large number of bills introduced into Congress, including the bill to reorganize the Executive branch of the Government, known as the "Reorganization Act of 1937," the National Planning Act of 1938, and the bill to provide for the purchase of public lands for home and other sites.

The flood-control program has required the preparation of legislative reports on bills authorizing preliminary examinations and surveys on various watersheds not included in the Flood Control Act approved June 22, 1936, and an analysis of the most recent act authorizing the construction of public works on rivers and harbors for flood-control purposes and of the appropriation for flood-control purposes.

The land utilization and land conservation program, initiated under the National Industrial Recovery Act and the Emergency Relief Appropriation Act of 1935, now been transferred for administration under title III of the Bankhead-Jones Farm Tenant Act, which provides for a permanent program of this kind. The Executive and administrative orders making this transfer were prepared in this Office. A large number of the projects in-

cluded in the program will be administered through various Federal, State, and local agencies. Work has continued on the preparation of a series of long-term leases and cooperative agreements for use in transferring projects to State and local agencies, a series of Executive orders transferring projects to other Federal agencies, and a series of administrative orders transferring projects to various bureaus within the Department. Papers have also been drawn for the incorporation of a few grazing associations which will assume administrative responsibility for some of the projects.

The land utilization program has required legal work by the Office on problems arising in connection with its three phases of acquisition, development, and management. These problems involve exchanges of land, reconveyances of title to land erroneously acquired, use of conservation land for resettlement purposes, construction contracts, well-drilling contracts, private claims for damages due to construction activities, grants of concessions on project areas, sales of timber, rock, and gravel, disposition of surplus property, exploitation of mineral resources under the land, exchanges of forest products, regulation of hunting and fishing, establishment of State game refuges, grants of highway, pipe-line, telephone, and power-line rights-of-way, grants of use permits, the right of residents on the project areas to school facilities of the State, the right of the State to sell for delinquent taxes land acquired by the Government, compromises of rent agreements, and the acquisition of water rights.

Eviction cases and cattle, sheep, and timber trespass cases have been prepared and submitted to the Department of Justice for prosecution.

FARM SECURITY DIVISION

The Farm Security Division of the Office consists of the rehabilitation section and the farm loan section. In the rehabilitation section the Office has concerned itself with the legal phases of the rehabilitation loan and grant program of the Farm Security Administration, authorized by the Emergency Relief Appropriation Act of 1937 and prior relief acts. Loans and grants have been made to individuals pursuant to individual rehabilitation or relief plans. Loans have also been made to individuals to enable them to participate in cooperative endeavors and to reliabilitation cooperatives directly. As to each activity under this program the Office actively participates in the formulation and revision of basic regulations and detailed procedure.

In carrying out the individual loan and grant program, many legal documents were drafted. Most important were the drafting of nearly a hundred lien and related forms to secure the loans made. Included were real estate, crop, and chattel mortgages and promissory notes, leases, and assignments. Special forms were frequently required to meet peculiar local law and conditions or the exigencies of specific cases.

For the collection of individual loans, there were drafted different types of renewal and extension agreements, releases of mortgaged property, and satisfactions of mortgages and other liens. Here again the peculiar conditions in specific cases necessitated the drafting of numerous individual instruments in order to avoid hardship on particular clients or to prevent impairment of the Government's security. Sometimes, previous procedures were modified or revised completely in the light of experience. Loan accounts are maintained by the Treasury Department, and many conferences were held with that Department, which resulted in the issuance of numerous interpretations of loan accounting and collection regulations for the guidance of administrative and legal regional officers. The Office referred some 800 defaulted collection cases to the Department of Justice for civil action, in accordance with a new procedure devised in cooperation with that Department. In addition, the regional administrative officials referred about 1,200 other cases to the regional attorneys of the Office, in which cases either collection was made without litigation, through the efforts of this Office, or the cases were dropped, because it was determined that litigation would neither bring in the collections nor have any salutary effect upon collections generally in the area involved. This Office also handled about 700 bankruptcy matters and advised on the proper handling of about 1,800 deceased clients' accounts. Thousands of questions relating to individual loan accounts have been disposed of by the Office.

In connection with the rehabilitation cooperative program, the regional and Washington offices examined about 1,000 applications. The greater number of

these involved loans to individuals to engage in existing or proposed cooperatives. Where a substantial number of participating loans concerned one cooperative, its legal organization was examined in the light of local law and Federal requirements. All cooperatives to which loans were made directly were examined to insure proper legal organization. This necessitated study of the varying local laws authorizing cooperative activities. In many instances, revisions of legal organization were requested as a condition precedent to the making of the loan. The Office prepared the various security instruments involved in these loans, including real and chattel mortgages, assignments of patronage dividends, and membership and marketing agreements, and, in connection with two cooperative loans concerning rural rehabilitation corporation projects, organized local corporations. When it was proposed to make participating loans to some 15,000 clients to procure membership in two large cooperative wheat-marketing associations, the Office, after conferences with legal officers of the Farm Credit Administration, drafted the necessary legal forms and prepared the entire financing plan.

In connection with the collection of cooperative loans, the Office has advised in the formulation of a collection procedure for direct loans to cooperatives, and has examined for legal irregularities cooperative associations' audit reports which have been referred to it. In a number of these cases, the administrative officials were advised of irregularities requiring correction.

The rehabilitation section also handled the legal problems incident to the transfer of the assets of five rural rehabilitation corporations. These were in addition to the 34 corporations which had already transferred their assets. There were also prepared 11 amendments supplementary to agreements which had been previously executed. The conveyance to the Government of real property owned by these corporations raised many problems. The coordination of the management of corporate assets with established governmental procedure continued to be a source of troublesome problems, as was the case in prior fiscal years, because of the novel trust arrangement and the diverse methods previously utilized by these corporations in the conduct of their affairs.

Numerous investigation reports have been considered in order to reach a legal determination as to civil or criminal liability of rehabilitation-program employees. Employee irregularities usually consisted of falsification of accounts. One hundred sixty-three cases were examined; 85 were referred to the Attorney General and the General Accounting Office for appropriate action; 18 were referred to the General Accounting Office for set-offs or other adjustments only; 60 were referred to the regional offices or the administrative authorities for adjustment. In addition, a hundred or more cases, mostly involving the unauthorized disposition of mortgaged property, were given consideration. The Office further cooperated with the Department of Justice in the prosecution of referred cases.

The Office has also concerned itself with the legal problems involved in the administration of title I of the Bankhead-Jones Farm Tenant Act. These legal problems were entirely new to this Department because, for the first time, a loan program was being initiated for the purchase of farms and the construction thereon of repairs and improvements. It was, therefore, necessary to prepare a large number of legal documents and to devise a procedure for the expeditious determination of the question as to whether the United States was obtaining, in the individual case, the form of security required by the act. While the Office has had considerable experience in title examination in connection with the direct acquisition of land by the Government, the considerations present in the question as to whether, as a matter of local real estate law, the United States was securing a first lien, were to some extent different. Thus it became necessary to examine the field of real estate mortgage law, and related fields, such as the priorities of mechanics' and material-men's liens, in each jurisdiction. To get the program under way, there were drafted 152 legal forms, including deeds, mortgages, options, construction contracts, waivers of liens, leases and licensing agreements, and loan agreements. There were also prepared 10 general procedures for the guidance of administrative officials and regional legal officers. In accordance with these procedures, about 2,000 loan dockets were examined.

The Office also prepared or revised, or assisted in the preparation or revision of, a number of Secretary's memoranda, administrative orders, instructions, and notices.

COMMUNITY PROJECT DIVISION

The legal problems presented by the community project program of the Farm Security Administration have been of wide variety, but may be divided roughly into two classes: One is concerned with the problems arising in connection with the planning, construction, and organization of resettlement community projects, and the other with the problems involved in their management and operation and with the organization and supervision of cooperatives and other homestead organizations functioning at such projects.

At these resettlement community projects of the Farm Security Administration in a number of different States, 24 cooperative associations have been organized by the office, and, in connection with their organization, there have been prepared 24 articles of incorporation, 24 sets of bylaws, 35 sets of corporate minutes, and 12 forms of membership or stock certificates. There have been revised or reviewed 9 articles of incorporation, 13 sets of bylaws, 5 sets of corporate minutes and 2 forms of certificates. In connection with loans made to cooperative associations functioning at these projects, 27 loan dockets were reviewed to insure compliance with the applicable legal requirements and administrative regulations, and various instruments of security and collateral for the repayment of such loans were prepared or reviewed. In connection with the administration of these corporative associations, the Office has prepared or reviewed a great many leases and contracts, including conditional sales contracts, and many tenure and miscellaneous forms. There were prepared, also, a number of proposals for the establishment of industrial enterprises at resettlement projects, chattel and real estate mortgages, and bonds, bills of sale, and deeds. The Office assisted in a number of suits instituted by the Department of Justice for the eviction of homesteaders on various resettlement projects.

In connection with the administrative activities of the Farm Security Administration, the Office has prepared or reviewed many articles of incorporation and bylaws and some amendments thereof; also many sets of minutes, forms of certificates, real estate mortgages, and bills of sale have been prepared, as well as lease-and-purchase contracts, construction contracts, resettlement-type leases, conditional sales contracts, performance bonds, temporary licensing agreements, deeds of trust, chattel mortgages, conditional sales contracts, and tenure forms.

In connection with the construction of the act of June 29, 1936 (49 Stat. 2035), in addition to legal advice given during the negotiations leading up to the agreements to make payments in lieu of taxes to various local public taxing units, the Office examined nearly a thousand requests, combined with resolutions, submitted by local governmental subdivisions and prepared the same number of agreements. Of these agreements, more than half have been executed and findings of fact in support thereof have been drafted. In accordance with section 4 of the act, which requires that easements and dedications to public bodies be granted only after the approval of the President, a number of presidential letters of approval were prepared, and there were drafted or revised a great many easements for utility companies and conveyances to local units of government for parks, roads, playgrounds, schools, etc.

At the request of administrative officials of the Farm Security Administration, replies have been made to many Notices of Exception taken by the General Accounting Office, suspending credit for payments made by disbursing officers for lands acquired in connection with the subsistence homesteads projects. In nearly all these cases, the credit requested was allowed and the others were still pending action by the General Accounting Office at the close of the year.

Attorneys of the Office cooperated with the Department of Justice by rendering assistance in connection with several specific performance suits, and 12 investigation reports, involving irregularities on resettlement projects, were also examined, and there were prepared or revised, or assistance was given in the preparation or revision of, 2 Secretary's memoranda, and 56 administrative orders and instructions.

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REPORT OF THE CHIEF OF THE WEATHER BUREAU, 1938 [1]

UNITED STATES DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
WASHINGTON, D. C., *August 25, 1938.*

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith a report of the work of the Weather Bureau during the fiscal year ended June 30, 1938.

Sincerely yours,

WILLIS RAY GREGG, *Chief.*

CONTENTS

	Page
Introduction	1
Training of personnel	2
International conferences	2
Meteorological research	3
Investigations under the Bankhead-Jones Act	4
Air-mass analysis	4
Progress in applying new synoptic aids to day-to-day forecasting	5
Instrumental equipment	7
Aneroid barometers and barographs	7
Wind direction contacting bearing	7
Storm-warning towers	7
Exhibits	8
Forecast and warning service	8
Establishment of station on Swan Island	8
Distribution of weather information, forecasts, and warnings by radio	8
Aerological observations	9
Radiometeorograph and airplane observations	9
Pilot-balloon observations	9
Service in aid of air navigation	9
Reorganization and expansion of the river and flood service	11
Marine climatology as an aid to agriculture	11
Library	12
The weather of 1938	12
Autumn of 1937	12
The winter	13
The spring and summer	13
Recent droughts	13

INTRODUCTION

In the four annual reports preceding this one chief emphasis has been placed on the great importance of (1) a broad, comprehensive program of research and (2) effective cooperation with other organizations, both governmental and nongovernmental, including particularly the meteorological services of all other countries. Unless special attention is given to these two requisites, real progress in meteorological service is impossible.

In the development of any service in which a steady though gradual growth is desirable to enable it to meet progressively increasing demands, it is necessary and stimulating, from time to time, to pause briefly, make a study of what has been accomplished and, to a certain extent, start afresh, concentrating on those parts of the service that are shown to be weakest, and eliminating or reducing those which may formerly have been important but the need for which has largely ceased—in other words, "putting first things first".

When, 4 years ago, in response to recommendations of the Science Advisory Board, a program was adopted which had as its purpose the introduction of new procedures and particularly a change of attitude in the Weather Bureau which would enable it to modernize its service in line with recent thought and

[1] Since the following report was written, the death of Dr. Gregg occurred on September 14, 1938, at Chicago, Ill., where he was attending an aviation conference between the Civil Aeronautics Authority and the Air Transport Association of America.

practice elsewhere, it was fully recognized that there would be an ever-present danger, on the one hand, of drifting back into practices that had long since ceased to be useful and, on the other, of failing to preserve a proper sense of balance among the newer procedures, only recently introduced. An occasional careful survey or "taking of stock," along the lines indicated in the preceding paragraph, is the only sure way to guard against this danger. Such a survey has been made during the past year. It revealed considerable progress. It also showed the need of a reorientation along some lines. By means of a series of conferences and the work of a number of committees important changes have been and are being made, all designed to increase the efficiency of the service in all its branches. Special attention is being given to the training of personnel, to the complete standardization of the service in accordance with international practice, and to research. In the following pages is presented a discussion of these topics, together with brief reviews of the Bureau's activities and a summary of the weather during the fiscal year.

TRAINING OF PERSONNEL

The program of detailing field personnel to the central office, briefly referred to in the last two annual reports, was continued, and its effectiveness was increased by assigning a trained air-mass analyst to the field to give instruction at different stations. Significant results have come from this program, but it has been recognized that it should be supplemented by sending a few outstanding men to educational institutions for advanced instruction. Efforts to secure authority for this purpose were finally successful, in the passage of the Civil Aeronautics Act, approved June 23, 1938. Among its provisions are:

SEC. 304. The Administrator is empowered and directed to make recommendations to the Secretary of Agriculture for providing meteorological service necessary for the safe and efficient movement of aircraft in air commerce.

SEC. 803. In order to promote the safety and efficiency of aircraft to the highest possible degree, the Chief of the Weather Bureau, under the direction of the Secretary of Agriculture, shall, in addition to any other functions or duties pertaining to weather information for other purposes, (1) make such observations, measurements, investigations, and studies of atmospheric phenomena, and establish such meteorological offices and stations, as are necessary or best suited for ascertaining, in advance, information concerning probable weather conditions; (2) furnish such reports, forecasts, warnings, and advices to the Authority, and to such air carriers and other persons engaged in civil aeronautics as may be designated by the Authority, and to such other persons as the Chief of the Weather Bureau may determine, and such reports shall be made in such manner and with such frequency as will best result in safety in air navigation; (3) cooperate with any person employed by air carriers in meteorological service; and (4) detail annually not to exceed ten members of the Weather Bureau personnel for training at Government expense, either at civilian institutions or otherwise, in advanced methods of meteorological science: *Provided*, That no such member shall lose his individual status or seniority rating in the Bureau merely by reason of absence due to such training.

The authority contained in section 803 (4) for the detailing of personnel to educational institutions for advanced training is of fundamental importance and significance in the development of meteorological service in this country. Plans are being worked out to put this legislation into effect, to the full extent that funds will permit.

INTERNATIONAL CONFERENCES

The past year has been a particularly active one in international meteorology. The first meeting of the newly formed Commission on Aeronautical Meteorology was held in Paris in June 1937. September 1937 was marked by conferences of Regional Commission III (South America) at Lima, Peru, and of the International Meteorological Committee at Salsburg, Austria, the latter being preceded by meetings of commissions on agricultural meteorology, climatology, synoptic weather, and projections for meteorological charts, and of two subcommissions on medical meteorology and on sea swells. A conference of directors of meteorological services in the southwest Pacific was held at Wellington, New Zealand, in December 1937. Finally, representatives of several countries concerned with meteorological service for trans-Atlantic aviation met at a conference in Dublin, Ireland, during March 1938. The Weather Bureau was represented by one or two officials at all of these conferences. It has membership in nearly all commissions and the Chief of Bureau is a member of the International Meteorological Committee and president of the Commission on Projections for Meteorological Charts and of Regional Commission IV (North America).

Of special importance was the conference held at Lima. It was the first meeting of Regional Commission III, which is composed of the directors of

national meteorological services in South America who are members of the International Meteorological Organization. It was held concurrently with a meeting of the technical aviation conference.

Regional Commission III was organized in accord with a resolution passed by the International Meteorological Organization at Warsaw, Poland, in 1936. Therefore, the Regional Commission III meeting at Lima was not only its first but it probably was the most important assemblage of meteorologists ever held in South America. Moreover, it was the first time that representatives of the United States Weather Bureau have participated in a meteorological conference in South America.

A number of meteorological problems of mutual concern to North America and South America were discussed. Among the resolutions passed was one urging that a similar regional commission (No. IV) be formed to consist of the meteorological services of North America, Cuba, and the West Indies. This and other resolutions were a recognition of the fact that travel between the countries of the Western Hemisphere, especially by airplane, and other business relations on which weather has important bearing, make it necessary that there be more intimate international understandings and coordinations than ever before concerning meteorological work in the Americas.

For many years the meteorological services of Canada and the United States Weather Bureau have been active members of the International Meteorological Organization, and they have had close cooperation with neighboring government meteorological institutions, but there has been no organized regional coordination. Regional Commission IV is being formed, and in due time it is expected that there will be a joint meeting with Regional Commission III.

METEOROLOGICAL RESEARCH

Active research progressed on a number of problems covering a wide field in meteorology and its practical applications. The results of research by the Weather Bureau are made generally available through the medium of the Monthly Weather Review, which, in addition to its function of promptly disseminating climatological and weather data and reports for public use, also provides limited facilities for the publication of contributions to meteorology by personnel of the Bureau and to a small extent by others.

Among the more important research papers of most general interest that appeared in the Monthly Weather Review may be mentioned: Review of United States Weather Bureau Solar Radiation Investigations, by I. F. Hand (vol. 65, pp. 415–441), a summary and discussion of the solar-radiation observations and investigations of the Weather Bureau to date; On the Relation Between Rainfall and Streamflow—III, by R. T. Zoch (vol. 65, pp. 135–147), a further contribution to the mathematical investigation of flood forecasting; The Geometrical Theory of Halos—IV, (vol. 65, pp. 190–192), and V, (vol. 65, pp. 301–302), by E. W. Woolard, continuing the investigation in meteorological optics begun last year; Formation of Polar Anticyclones, by H. Wexler (vol. 65, pp. 229–236), a further contribution to the investigation of North American cold waves that has been in progress during the past 2 years; On Some Properties of the Water Vapor Spectrum and their Relations to Atmospheric Radiation, by W. M. Elsasser (vol. 65, pp. 323–326), the initial contribution to a comprehensive investigation of the fundamentally important part played by absorption and radiation by water vapor in the atmosphere; On the Thermodynamic Interpretation of Isentropic Charts, by H. R. Byers (vol. 66, pp. 63–68), a discussion of the construction and application of the isentropic chart in the form finally developed by the Weather Bureau; The Normal Temperature Distribution of the Surface Water of the Western North Atlantic Ocean, by G. Slocum (vol. 66, pp. 39–43 and 16 charts), making generally available the data in the records of the Weather Bureau; Shielded Storage Precipitation Gages, by J. C. Alter (vol. 65, pp. 262–265), a report on a long series of experimental investigations of the measurement of snowfall by the Weather Bureau. Two reports dealing with progress in the development of the radiometeorograph appeared: A Series of Radiometeorograph Soundings during February–April 1937, by C. Harmantas and D. P. Keily (vol. 65, pp. 219–229); and Report on the Weather Bureau Radiometeorograph Program, by L. T. Samuels (vol. 66, pp. 93–95). In addition, two important reports on international cooperation among meteorological services were published: Advances in International Meteorology in 1936–37, by W. R. Gregg (vol. 65, pp. 385–387); and International Standard Projec-

tions for Meteorological Charts, by W. R. Gregg and I. R. Tannehill (vol. 65, pp. 411–415).

INVESTIGATIONS UNDER THE BANKHEAD-JONES ACT

With allotments from the special research fund provided by the Bankhead-Jones Act, the investigation of cold waves in North America, which was begun during the preceding fiscal year, was continued in cooperation with Massachusetts Institute of Technology and the Bureau of Agricultural Economics; and a further project for the study of warm and cold anticyclones and the role of ozone as a possible link between solar activity and atmospheric changes was begun in cooperation with the same agencies. These investigations are a part of the general weather- and crop-forecasting research program of the Department of Agriculture.

The upper-air soundings at Fairbanks, Alaska, were made with the radiometeorograph, checked by periodical airplane flights. The statistical and theoretical study of data obtained by upper-air sounding and other special observations at northern stations was continued and has enabled further extensions to be made of the quantitative theoretical-physical explanation of how cold-air masses build up in the far North during winter by radiational cooling at the snow surfaces and by the gradual upward spread of the cooling effect during the Arctic night. The observational program of this investigation has provided the opportunity to demonstrate the applicability of radiometeorograph soundings under extreme conditions; the experience gained will be of benefit in all activities of the service since it is planned eventually to replace all airplane soundings of the upper air by radiometeorographs.

In the theoretical part of the investigation increased emphasis was given to the study of the mechanism by which the accumulated cold air is eventually released and propagated in the form of a cold wave, and a promising beginning has been made in the solution of this problem. The release of cold-air outbreaks seems to be closely related to the circulation aloft of the warmer air in the dynamical warm Highs of lower latitudes. The originally distinct investigations of cold Highs and warm Highs have thus been brought together in a single investigation of the general circulation of the atmosphere between northerly and southerly latitudes.

In the course of these investigations fundamental advances in understanding the dynamics of atmospheric circulation have already been effected, largely by utilizing recent advances in fluid mechanics, particularly the theory of lateral mixing and dissipation in wake streams; and opportunity has been provided to develop and apply important methods that are also of general application in regular daily meteorological and forecasting work—especially the isentropic chart, which gives promise of great usefulness in daily forecasting and in obtaining and understanding of weather abnormalities such as periods of flood or drought. The large-scale features of atmospheric circulation determined by cold and warm anticyclones are of fundamental significance for the large-scale trends, changes, persistencies, and abnormalities of weather that are especially important for long-range forecasting.

In the study of the possibility that ozone in the upper atmosphere may act as a link between solar activity and meteorological phenomena in the lower atmosphere, a survey of present knowledge has been completed; and it is planned to start observations of ozone in the United States to investigate the correlations between ozone distribution and weather which have previously been found to exist in Europe.

AIR-MASS ANALYSIS

Progress has continued in the development of frontal, kinematic, and thermodynamic analysis of synoptic maps and vertical cross sections. In particular, investigations have been made of upper-air cold fronts and upper-air pressure maps and the results put into daily use. Upper-air charts of conditions on isentropic surfaces have been developed and their application in daily forecasting extensively studied. The properties, progressive modifications, and distinguishing characteristics of the air masses of the United States have been summarized anew and have shed new light on air-mass modifications and resulted in a simpler and more practical classification of North American air masses. Improved and simplified cross sections have been developed; improved methods for the thermodynamic interpretation of charts and cross sections have opened up new lines of investigation that have led to preliminary conclusions about the dissipation of fronts at high levels which partly invalidate

the Norwegian conception of the occluded cyclone. General-forecast studies have also been continued as in the past.

PROGRESS IN APPLYING NEW SYNOPTIC AIDS TO DAY-TO-DAY FORECASTING

In the development of the science of weather forecasting there has been a sort of friendly competition between the practical and the theoretical schools. When observations were confined largely to surface conditions, most of the contributions came from the practical side because it was difficult to shape the practical problems into a form susceptible of treatment by the then-known physical methods. Later, as an increasing amount of information from the free air was made available by means of kites, sounding balloons, pilot balloons, mountain observatories, etc., more and more theoretical contributions appeared. Thus was narrowed the gap that existed between the practical and theoretical schools and, while there still remains a gap, it is surely and steadily decreasing.

Clouds, the observation of which gave us our first, though incomplete, knowledge of the free air, were supplemented by sporadic observations of pressures, temperatures and humidities from kites and sounding balloons carrying meteorographs. These in turn were followed by regular once-a-day and later by twice-a-day pilot-balloon programs. It was not, however, until the inauguration of daily airplane observations from a network of stations that sufficient information in the vertical was obtained to give a fairly comprehensive picture of the structure of the lower half of the troposphere. Still more recently the radio-meteorograph has extended our daily information into the substratosphere and has assured observations even under weather conditions so adverse that planes cannot function.

Following the World War, a series of truly phenomenal advances in forecasting began. The announcement of the frontal concepts by Bjerknes, Solberg, and Bergeron was followed by studies of air masses by Bjerknes and Bergeron in Europe and by Rossby, Willett, and Byers in this country. The next important step was the development of kinematical computations on the movement of pressure systems, fronts, etc., by Petterssen and later by his contribution on frontogenesis and cyclogenesis, etc. The latest advance, which has already demonstrated practical applications and holds out definite promise of further usefulness, is that of Rossby's investigations of flow patterns of moist and dry tongues as shown on the isentropic charts suggested by Napier Shaw many years ago. Many cases of precipitation cannot be explained by means of the frontal concepts. Of those heretofore unexplained cases, the flow patterns on isentropic surfaces explain a considerable number—limited somewhat by the openness of the network of airplane stations and by the fact that such observations are available only once a day.

This series of epochal developments has been made possible not only by systematic daily observations in the free air from a network of stations but also by the recognition of the need for promoting and encouraging studies in dynamic meteorology by some of the more progressive universities and meteorological institutions. There is every reason to expect that, with the development of new tools in the way of concepts, more complete and frequent free-air observational material, and increasingly efficient methods of attack, this wonderful advance of the last decade or so will continue.

About 3 years ago a small group was organized in the Weather Bureau at Washington to carry on a program of instruction and investigation in weather-map analysis based on physical principles in the expectation that such methods would improve the forecasting work of the Bureau. This small group, usually referred to as the "air-mass group," prepares daily a general map, vertical cross-sections, isentropic charts, and energy diagrams when necessary. Conferences are held at 11:15 a. m. at which a leader carries through a complete analysis of the current map and traces the evolution of the fronts and the changes in air masses. Those who attend the conferences, 10 to 15 in number, offer suggestions and take part in the discussions. Following the analysis, the leader presents a map showing his predicted positions of the fronts and the centers of high and low pressure and the pressures to be expected at the centers on the following morning, as well as any indications of new developments of centers and fronts. In presenting this forecast map, the leader describes the kinematic calculations he has made as well as the calculations on the movements of the fronts based on the geostrophic wind scale and gradient winds. He also indicates where the genesis or dissolution of fronts, cyclones,

and anticyclones is likely, giving the reasons for his conclusions. In a general way he points out the regions in which precipitation is to be expected on the basis of frontal considerations and also on those of the isentropic charts. Occasionally an attempt is made to indicate in a general way the future movement of the moist tongue on the isentropic chart.

These conferences serve not only to instruct personnel who are engaged, or will in a short time engage, in forecasting either on the airways or at the district forecast centers, but assist the forecaster on duty by providing a complete and thorough analysis of the morning chart for the current day. This analysis is of considerable value even though it follows the making of the morning forecast.

All have access to published accounts of recent ideas and developments in forecasting; and in the air-mass group all of these that seemed to have any virtue have been given a thorough trial. It is the Bureau's policy to disseminate information regarding these newer ideas and methods to its forecasters just as quickly as possible. To this end, small groups of field men have been brought in from time to time to the central office to attend the daily air-mass conferences and to receive a course of lectures for a period of 2 or 3 months. In addition, one man is attached to the airway service who visits stations where he can be of the greatest help. At present there is hardly a forecast center, either district or airways, that has not had at least one of its men assigned to Washington for this instruction. At the central office, where the forecasters have the benefit of daily contact with the work of the air-mass group, every effort is made to employ these aids so far as possible in the time available in their daily forecast work. After the data are charted, the forecasters have from 15 to 30 minutes to study the situation before beginning the forecasts, whereas a complete detailed analysis requires a minimum of 2 hours. However, with the historical groundwork of a thoroughly analyzed chart of the previous morning and a less complete analysis of the 1:30 p. m., the 7:30 p. m., and the 1:30 a. m. charts, a good deal can be accomplished in the 15 to 30 minutes available. The time is generally sufficient for a rapid placement of the well-marked fronts and the fitting of the isobars to them, as well as for the location of some of the fronts that are not so well marked but which often become important later. The vertical as well as the horizontal distribution of wind, temperature, and moisture is studied in order to get a picture of the air masses and the interactions between them. When frontal considerations do not explain the precipitation, an attempt is made to ascribe it to instability brought about by convergence or convection or to moist tongues flowing up isentropic surfaces. Following this very hurried analysis, a little time generally remains to make calculations of the movement of the more important fronts and the principal centers of low pressure and high pressure by kinematical methods, geostrophic wind scale, or gradient winds. If time is available, calculations are made for the local afternoon conditions, such as for maximum temperatures based on the local aerograph and, during the summer season, of the possibility of afternoon thunderstorms from an energy diagram.

To speed up the work of charting as much as possible and to make the forecaster's maps adapted in a more adequate manner to forecasting from a physical point of view, a number of changes have been made in the organization and charting of the observational data. Instead of wind velocity being entered in miles per hour, it is now indicated by barbs on the wind-direction arrow. Many of the international symbols for present weather have been adopted. The important fronts are drawn on manuscript maps and the isobars fitted to them. Barometric tendencies are entered on the weather map as well as on the pressure-change map. Pilot-balloon observations are plotted for elevations above sea level instead of above surface. State of sky is coded now in four groups, clear, scattered, broken, and overcast, instead of in three as formerly, and the character of precipitation is indicated. Diagrams showing results of airplane and radiometeorograph observations are plotted on graphs having pressure as the ordinate instead of height. Other changes are in contemplation, all looking to a greater use of physical methods in the daily forecast work.

Considerable time and effort have been devoted to finding some generalized method whereby the forecasters could obtain some, at least, of the benefits of a more complete analysis. Lately a special point has been made of prompt preparation of the isentropic charts in an endeavor to have them available to the forecaster in time for use. The best performance so far has been to have them ready between 9:25 and 9:30 a. m. part of the time, which, of course, is rather late. Aside from the question of making detailed analyses, to which

reference has been made, it has been realized for some time that the fuller, more complete and better distributed observations available in the last few years have not been utilized to the greatest advantage because of the lack of time for proper study. No way to overcome this difficulty has been suggested that will not involve a very radical and difficult change in present schedules.

It was formerly supposed that a more comprehensive knowledge of weather processes and more complete information regarding them would both clarify and simplify the problem of weather forecasting. In actuality, though the problem has been clarified, it has not only failed to become simpler, it has become many times more complex—yet for that reason far more interesting.

INSTRUMENTAL EQUIPMENT

The chief function of the Instrument Division remains as heretofore to select, procure, and test instrumental equipment for the Weather Bureau and to see that it is employed in a way to insure the soundest results possible. However, methods of accomplishing these results have greatly changed. The recent increase in funds available for upper-air soundings and airway service has attracted the attention of manufacturers and contractors. As a result there has been a great increase in development work by manufacturers and many of them offer the Bureau their wares. Of these wares some represent the work of highly skilled technicians and others that of persons lacking the requisite skill and experience. Present-day regulations practically compel the acceptance of the lowest bid. The result of all this has been to impose an unusual degree of responsibility upon the Division in the preparation of purchase specifications for instrumental equipment for general weather service, airways, and upper-air soundings.

With the fine cooperation of the personnel of the Division there is gradually being built up a set of purchase specifications embodying the results of the experience gained in making previous purchases. However, the intense effort required for this phase of the work hinders the application of the resources of the Division to the improvement and development that it would like to carry on. Still this careful attention to specifications has resulted in many improvements made by manufacturers in the equipment offered.

ANEROID BAROMETERS AND BAROGRAPHS

Specific improvements in the instrumental equipment in the field service should be mentioned. A new aneroid barometer that performs satisfactorily over a range of 3 inches or more in pressure, and under temperature changes varying from near the freezing point to summer temperature, is now being manufactured by an American concern, and is available at a price under $20 each; about 100 have been purchased. An aneroid barograph, well compensated for temperature, is being marketed by an American firm. It is fully equal and, in respect to temperature compensation, superior to instruments of this type previously available. It is available in both 1 to 1 and 2½ to 1 pressure ratio. The latter is being preferred by Weather Bureau meteorologists, and it is expected that within the next 6 months practically the entire Bureau will be equipped with them.

WIND-DIRECTION CONTACTING BEARING

A wind-direction contacting bearing equipped to transmit 8 points of wind direction has been developed, and a dial indicating direction to 16 points by means of 8 lights has been developed to go with it.

Experimental trials of this device equipped with four additional contacts to permit simultaneous operation from one vane to the triple register in one place and an indicator dial or several dials in other places give promise of success.

STORM-WARNING TOWERS

Storm-warning display towers and lanterns have not been eliminated from the picture by radio as many had anticipated. On the contrary, present practice calls for the replacement of oil-burning equipment by electric lights. This is due largely to the extension that has taken place in electric service lines.

A new 85-foot tower built entirely of wrought iron has been procured and erected at Tatoosh Island, Wash. It is confidently hoped that this tower will resist satisfactorily the severe corrosion that takes place at that point.

EXHIBITS

During the year two instrument exhibits were assembled and arranged for display; one, at the Weather Bureau office at Charleston, S. C., in connection with ceremonies conducted by the city of Charleston commemorating the two-hundredth anniversary of the first instrumental weather observations in the United States; the other, at the Benjamin Franklin Institute, Philadelphia, Pa., upon the occasion of the dedication of the Benjamin Franklin Memorial in the Institute building. Both of these exhibits created considerable public interest and were well attended. The Instrument Division has also been in direct contact with representatives of the New York World's Fair and the Golden Gate Exposition in working out details of that portion of the Government exhibits dealing with the weather service of the United States. Both of these fairs are to open during the next fiscal year.

FORECAST AND WARNING SERVICE

ESTABLISHMENT OF STATION ON SWAN ISLAND

Arrangements were made for the operation during the hurricane season of 1938, of a meteorological station on Swan Island, in the Caribbean Sea about 200 miles south of the extreme eastern end of Cuba. The station is maintained in cooperation with the United States Navy, which furnished and operates the radio equipment, the observer and meteorological instruments being supplied by the Weather Bureau. For a number of years this island was utilized by the Tropical Radio Telegraph Co. as an important relay point in its radio service for the United Fruit Co. Observations from Swan Island were obtained regularly until the radio company ceased its major operations thereon. Thereafter, for a few years observations were obtained in August, September, and October by contract with the Tropical Radio Telegraph Co., which sent operators and radio equipment to the island for that specific purpose. This plan had to be abandoned in 1933 because of the large expense involved.

In former years weather reports from Swan Island were highly valuable in connection with the issuing of warnings of hurricanes, and it is satisfying to know that reports will in the future be available therefrom in the event of hurricane occurrences in that region. This station and the one established by the Government of Cuba on Grand Cayman Island in 1935 will ensure regular and reliable observations of special value in the issuance of warnings to Cuba and the southern coasts of the United States.

Like the preceding one, the last season (June 16 to November 15) was exceptionally free from tropical disturbances. Nine were recorded, and only two were of hurricane severity. No part of the United States or its possessions was affected. This was in contrast with the record year of 1933, when 21 tropical storms occurred. Several of them were of hurricane proportions, and much damage was done at places on our South Atlantic and Gulf coasts.

DISTRIBUTION OF WEATHER INFORMATION, FORECASTS, AND WARNINGS BY RADIO

Radio broadcasting stations have been cooperating with the Weather Bureau in disseminating weather information since the first voice programs were begun in 1920. The number of broadcasting stations now cooperating in this work has steadily increased and totaled 450 at the end of the fiscal year.

In an effort to improve this form of service, microphones connected with local broadcasting stations have been established in a number of Weather Bureau offices, and forecasts, weather data, and other meteorological information are given direct by officials of the Bureau. Several additional microphone installations were made during the year, the number now in operation being 30. These announcements are made on schedule several times a day and oftener when severe conditions, such as cold waves, floods, heavy snows, frosts, etc., are impending.

Expansion has been made in distributing weather information from Coast Guard and lighthouse radiophone stations located on the Atlantic, Gulf, and Pacific coasts and in the Great Lakes areas. This service was inaugurated principally for the benefit of fishing boats, tugboats, and other types of small craft. The number of participating radio stations is now 18. Broadcasts are made twice a day, but when storm warnings are issued they are repeated every 2 hours. The cooperation by these Government agencies is highly efficient and benefits not only the owners and operators of small craft but also people for a considerable distance inland.

AEROLOGICAL OBSERVATIONS

RADIOMETEOROGRAPH AND AIRPLANE OBSERVATIONS

In view of the importance of developing satisfactory radiometeorograph observations, three different types of instruments were used during the year for making scheduled observations at Boston, Mass., Burbank, Calif., and Fairbanks, Alaska. The results of these soundings were compared with simultaneous airplane observations and were found to be generally satisfactory. As a consequence, plans were made to use radiometeorographs at six stations during the year beginning July 1, 1938.

Progress is reported in the development of the radiometeorograph at the National Bureau of Standards. The Weather Bureau is cooperating in the financing of this project. A number of these instruments were purchased and used in observations, with generally satisfactory results.

Cooperation was continued with the California Institute of Technology in the development of radio apparatus for obtaining wind directions and velocities in and above cloud layers. This important problem has not yet been solved sufficiently to make possible its use in observation work.

Airplane observations were made under contract with commercial operators at the same 12 stations as during the previous year, except that Chicago was substituted for Miami. The War Department discontinued airplane observations at Boston on December 31, 1937, and at seven Army fields on June 30, 1938.

An investigation of upper-air conditions in and around a tropical hurricane was undertaken in cooperation with the Massachusetts Institute of Technology. Since no hurricanes passed near the stations from which the balloons were to be released, the observations were made in an extratropical cyclone accompanied by heavy rains. A good number of the meteorographs have been found and returned, and analysis of the records will be made jointly by the Weather Bureau and the Institute.

The Weather Bureau again participated in International Month in August 1937 by releasing sounding balloons throughout the month at Omaha, Nebr. Nearly all of these meteorographs have been found and returned and the evaluated data furnished the International Aerological Commission.

PILOT-BALLOON OBSERVATIONS

Pilot-balloon observations by which upper-air winds are measured were inaugurated at two additional stations, located at Huron, S. Dak., and Sacramento, Calif. This brings the total number of stations to 79, including 3 in Alaska and 1 at San Juan, P. R. Action was taken to increase the number of pilot-balloon observations to four per day at all stations in continental United States. Observations with larger (100-gram) pilot balloons, capable of ascending to greater heights than those now in general use, were inaugurated at Las Vegas, Nev., and arrangements completed for similar observations to be made at 13 additional stations. The possibility of using helium instead of hydrogen for the inflation of balloons, in order to eliminate the danger of hydrogen explosions, was investigated and arrangements made whereby it would be used as a trial at a limited number of stations during the fiscal year 1939. The special research project of determining the ascensional rates of different types of balloons and the effects on the ascensional rates of substituting helium for hydrogen, was continued at Washington, D. C.

SERVICE IN AID OF AIR NAVIGATION

Three qualified forecasting assistants were added to the force of each of the 11 airway forecast centers to permit the maintenance of full 24-hour forecasting service and the preparation of supplementary charts necessary for the correct analyses of weather situations. Already this program has shown definite results in the direction of increased accuracy in the airway forecasts and has permitted the issuance of forecasts at 3-hour intervals when especially adverse conditions are present in a district.

One man and a light panel truck were added to each of the 11 general supervising stations for inspection and maintenance work. These inspectors, using the truck for transportation, visit all stations both on and off the airways in their respective districts in some instances four times a year, and while there, inspect the instrumental equipment, train observers in weather reporting, make recommendations for improvement of service, and handle other details which cannot be handled efficiently in any other manner. In addition, instrumental equipment, forms, and other supplies are carried by the inspector, thus saving considerable

amounts otherwise required for transportation. A distinct improvement in the data from substations has been noted since the institution of this program, and it is expected that this improvement will progressively increase as the inspectors become more familiar with their districts.

The instrumentation of about 150 stations was improved by the installation of ceiling projectors that project a more intense beam of light for illuminating a spot on a cloud layer as a means of determining the height of the layer. Similarly, about 120 stations were provided with new open-scale barographs for better determination of pressure-change characteristics; 100 were provided with mercurial barometers for accurate measurement of barometric pressure, and 50 stations were supplied with eight-point wind-direction indicators for accurately determining wind directions to 16 points of the compass or more. This has resulted in increased accuracy of observations from these stations.

New airport stations rendering 24-hour service and taking four pilot-balloon observations each day were established at 10 major air terminals, and one commissioned Weather Bureau employee was assigned in charge of each of 33 stations where formerly the weather-reporting work was performed entirely by noncommissioned airway observers. This has resulted in material improvement in the accuracy of reports rendered from these points and has greatly increased the facilities for proper meteorological service in aid of aviation at important points in the airway network.

The airway general supervising and forecast center at Dallas, Tex., was transferred to Fort Worth, Tex., to permit complete coordination of the receipt and transmission of meteorological data with the facilities of the Bureau of Air Commerce and to provide better contact with airline companies and personnel.

Several new off-airway, 6-hourly reporting stations were established to fill in gaps in the network of such reports. In addition, approximately 40 existing teletype or radio hourly reporting stations along the airways were equipped with additional instruments for the taking of special 6-hourly coded weather reports and the entering of such reports in special sequences run each 6 hours over the teletype and radio circuits. This program has resulted in a strategic increase in the number and distribution of synoptic reports available for use in connection with the preparation of detailed weather maps at all airport stations and the analysis of weather situations and issuance of airway forecasts.

In order that information might be available from strategic points off the airways for the preparation of supplementary weather maps and tracing developments in weather situations which might unexpectedly arise between the 6-hourly collections of synoptic reports, about 20 of the 6-hourly off-airway stations were organized to render reports at the 3-hourly intervals between the 6-hourly reports. Most of these stations are located along the Pacific coast and Canadian border in order to guard against adverse conditions from these areas of sparse reports reaching airways in the United States without advance warning, but others are also located at strategic points in the interior and along the Atlantic coast so that all areas are guarded against the occurrence of such conditions as much as possible.

Fifty-five new teletype stations established by the Bureau of Air Commerce during the year were furnished complete instrumental equipment needed for the taking of hourly or more-frequent weather reports.

There are now 62 first-order airport stations where weather maps, hourly weather reports, pilot-balloon reports, and meteorological advice or forecasts are available 24 hours each day, and there are 33 stations at which a commissioned Weather Bureau employee has been assigned in charge of three airway observers for the taking of hourly or more-frequent weather reports. In addition to these, there are 269 stations rendering hourly or more frequent weather observations, about 140 of which render 6-hourly coded synoptic reports; 314 stations rendering weather observations at regular times, or on call, to serve scheduled flights, and 145 off-airway stations rendering reports every 6 hours in the airway network, 20 of which render reports every 3 hours, or a total of 823 stations. Additional reports from stations in Canada, Mexico, and Central American countries and from ships at sea are received. Selected groups of reports from the above are relayed by teletype and radio to all Weather Bureau airport stations every 6 hours for the preparation of weather maps. The 11 airport stations, located at Newark, N. J., Arlington, Va., Atlanta, Ga., Cleveland, Ohio, Chicago, Ill., Kansas City, Mo., Fort Worth, Tex., Salt Lake City, Utah, Portland, Oreg., Oakland, Calif., and Burbank, Calif., supervise the service in their respective districts and issue 6-hourly airway regional and terminal forecasts for the periods 4:30 a. m. to 12:30 p. m., 10:30 a. m. to 6:30 p. m., 4:30 p. m. to 12:30 p. m., and 10:30 p. m. to 6:30 a. m., eastern standard time,

on the basis of observations made at 1:30 and 7:30 a. m. and p. m., eastern standard time.

REORGANIZATION AND EXPANSION OF THE RIVER AND FLOOD SERVICE

Reorganization of the river and flood service, which is responsible for the prediction of flood and navigation stages in the rivers of the United States, has progressed effectively in three directions: (1) Refinement of the observation and reporting system of effective rainfall in upstream basins of major drainage areas; (2) the analysis of rainfall and storm data for use by the Army in the design of flood-control works; (3) expansion of the mountain-snowfall service in the West.

Changes in the headwater-forecasting service on tributary and headwater streams have been so far confined mainly to the Northeastern States, with special concentration on the Allegheny, Monongahela, Delaware, Schuylkill, Susquehanna, Merrimack, and Potomac Basins. In this program about 160 recording rain gages have been established, many of them by cooperative arrangement with the United States Geological Survey and the Commonwealth of Pennsylvania. In addition, several new river-stage reporting stations have been established and the procedure of reporting refined, so that information on quantities and discharge of river flow may be in the hands of river forecasters from 6 to 24 hours earlier than has heretofore been possible.

The collection and tabulation in readily interpretable form of evaporation data for the country as a whole has progressed rapidly as a W. P. A. project of definite hydrologic value; and of outstanding importance has been the storm study of the River and Flood Division in cooperation with the Corps of Engineers of the Army. The purpose of this work is to deduce by hydrometorological methods, involving air-mass analysis and transposition of storms, the maximum flood-producing characteristics of regions in which the Army has flood-control works in prospect. These studies are conducted on a sound scientific basis and are expected to yield information of permanent value, not only for the immediate purpose of the Army, but also for present or future use in any program for land utilization or soil conservation in the area concerned.

The mountain-snowfall service has been improved by the establishment, in carefully selected areas, of 20 new stations equipped with batteries of five shielded snow gages, and it is expected that a like number will be established during the current year. Ultimately this service will be so organized as to provide accurate snowfall-runoff data for general river and flood forecasting on all significant drainage basins of the West.

In addition to the foregoing specific items, the general administration of the river and flood service is being expanded on a regional basis. The efficacy of this method of organization has now been adequately demonstrated by a year's operation in Regions 1, 3, and 4 (the North Atlantic, the Ohio Valley, and the upper Mississippi sections, respectively) in improved care of equipment, closer coordination of operations with other Government field services, more frequent contacts with observers and consequent improvement in records and reports, and, most important, in furthering the program of headwater prediction. The long-established forecasting methods for stage prediction by gage relationships, reliable though they are for the middle and lower reaches of the streams, are inadequate for the needed forecasting of upstream conditions. Inspections, studies, the installation of self-recording rain gages in headwater areas, and the establishment of highly efficient reporting methods have already produced a substantial groundwork for the advance of this work.

MARINE CLIMATOLOGY AS AN AID TO AGRICULTURE

Many investigators have thought that there is probably a useful relation between meteorological phenomena over the continents and the antecedent conditions over the oceans. To determine whether such a relation exists, it is necessary to know definitely the history of weather fluctuations, both over the continents to be studied, and over the adjacent, and possibly the distant, ocean areas. Such weather histories are available for the continental United States, covering a long period of years, but there are no parallel series of monthly values for temperature and other elements over the oceans. The areal distribution of marine data is very irregular. In many large areas the observations are scanty, and even within selected areas where ocean commerce has provided abundant data, the series of dependable values is relatively short. In the

present state of knowledge every new compilation that adds to the available body of normal or historical marine-weather data is of value to the investigator.

Under the sponsorship and technical supervision of the Weather Bureau the W. P. A. at New Orleans, La., is engaged in making a series of compiliations of meteorological data for the oceans. Approximately 5½ million observations collected from ships, mainly between 1885 and 1933, have been summarized, and the results have been transferred to world charts, which have been submitted for publication in the form of an atlas. Within the limitations of the available data, the normal conditions of wind, cloudiness, rainfall, fog, mist, haze, thunderstorms, and wet-bulb depression are shown by months or seasons for the navigable oceans of the world and temperatures by months for the North Pacific and North Atlantic Oceans.

Additional compilations and charts not to be included in the atlas are being prepared in special sub-projects with the same material serving as basic data. Ocean squares have been selected which are represented by an adequate body of observational data, and series of tables are being prepared for these squares to show the changes in temperature of the air and surface water from month to month and from year to year. Special studies are also being made of general weather conditions over ocean areas adjacent to the United States during abnormally wet or dry periods in the southern Plains States. It is hoped that the information in the atlas and other special data derived from this project will be useful in investigations of long-range forecasting, possibly by indicating a new and more profitable approach to the determination of the relation between oceanic meteorological conditions and subsequent continental weather.

LIBRARY

The Weather Bureau library has the largest collection of meteorological literature in the world. It is extensively used by the technical staff of the central office, and by the field stations of the Bureau, as well as by other governmental organizations and private institutions. Of late the demands on the library have increased because of both the natural growth of the Weather Bureau service and increasing interest in meteorological research. Nearly 200 periodicals are received by it, about 50 of which are purchased; the remainder are received by exchange with the Monthly Weather Review or are gifts. Many of these periodicals deal solely with meteorology; all contain items of interest for meteorologists from time to time. The library also receives publications from meteorological services and institutes throughout the world.

The library of the central office has supervision of the station libraries, and almost every Weather Bureau office, including those at airport stations, has a small station library. Action was taken to increase the volumes in these station libraries, thus increasing the efficiency of the station itself and also enabling each station to be of more service to the public.

Work on the Talman Meteorological Dictionary and Reference Book, which was referred to in the report for 1937, is continuing.

THE WEATHER OF 1938

Since the recent series of severe droughts extending up through 1936, weather conditions have been decidedly more favorable for agriculture. From the eastern Great Plains eastward, rainfall in most areas since the last extensive drought (1936) has not only been sufficient in most places for current crop needs, but subsoil moisture has largely been restored. There have been no widespread, harmful deficiencies in rainfall as during a number of the years immediately preceding. However, in the normally drier western Plains the reaction to better moisture conditions was delayed until the early part of 1938. In this area precipitation in 1937, while considerably more than during the preceding year, continued much below normal, and droughty conditions remained severe in a wide belt extending northward from the southwestern Plains. Moreover, subsoil moisture is yet far below normal in this area.

AUTUMN OF 1937

The weather during the autumn of 1937 was rather less favorable than in the summer of that year because of the scarcity of moisture in much of the western wheat belt which interfered with seeding and caused germination to be slow and uneven in many places. The deficiencies in moisture centered in the upper Mississippi Valley and northern Great Plains. Otherwise, the autumn weather was generally favorable, and grain crops, for the most part, entered the winter in satisfactory condition. The Eastern and far Western States had above-normal rainfall but some interior areas became decidedly dry.

THE WINTER

The winter of 1937–38 was characterized by more-than-normal warmth throughout practically the entire country. This was in marked contrast to the preceding winter, which was decidedly cold in the Midwestern and far Western States. Precipitation during the winter was unevenly distributed, but, in general, most sections west of the Mississippi River had above normal with relative dryness in Eastern States, especially the Southeast where a large area had only about half the normal rainfall. The Southeastern States, notably Florida, suffered heavy frost damage, especially to winter vegetables; otherwise, there was no extensive harm. In Florida cold weather started earlier than usual, with freezing temperatures reported as far south as Arcadia on November 21; early in December freezing extended as far south as the Lake Okeechobee section. Another freeze occurred in this State late in January, causing widespread damage to tender truck. Thereafter the weather was favorable.

THE SPRING AND SUMMER

With the advent of spring there was widespread, frequent rainfall, which supplied abundant moisture for crop needs rather generally, the season as a whole being characterized by warmth and wetness. In much of the interior, wet soil considerably delayed the planting of crops; cool weather during much of June retarded germination of corn. For the country as a whole it was one of the wettest springs of record, all States having above-normal rainfall, except those occupying a narrow belt in the extreme South from Florida to southern New Mexico, a limited northeastern area, and a few localities in the far West. However, a severe spring drought developed in Florida, which damaged truck and citrus fruit, especially the latter. The drought was broken the last of May, and thereafter, under the influence of abundant moisture, citrus groves improved rapidly, and a heavy June bloom developed. The spring brought considerable damage by freezing to wheat in the southwestern winter wheat belt, the unfavorable results of which, together with the deficiency of moisture during the preceding fall, became more apparent as the season progressed. Also, freezing weather caused considerable damage to fruit in the Central and Eastern States. Otherwise, weather during the spring and early summer continued generally favorable for crops, including small grains, except that during part of June dryness in the Dakotas, where subsoil moisture is still scanty, was rather unfavorable for spring wheat. The weather was outstandingly favorable for grass and hay crops. Widespread showers in the Corn Belt about the middle of July were timely and very helpful, while heavy rainfall in the more eastern States in July largely made up the deficiencies in moisture that had accumulated in these sections. In fact, the heavy July rains did considerable damage, heavy locally, to crops, small bridges, etc., in eastern and southern areas from New England to Texas.

For the period January to July 1938, about 90 percent of the United States had above-normal rainfall. All States reported above-normal rainfall except South Carolina, Georgia, Florida, Louisiana, South Dakota, and Washington. This is a very unusual condition for a period so long as 7 months. As compared with the normal, Nevada was the wettest State, with 157 percent of normal rainfall, followed closely by California, with 154 percent. The relatively driest States were Washington, in the extreme Northwest, and Florida, in the extreme Southeast, with 86 and 87 percent of normal, respectively. In most sections the rainfall during this period compared favorably with that for the same months of 1937, except that the Great Plains this year have had much more rain than during the preceding year.

RECENT DROUGHTS

Droughts of varying severity and extent occur practically every year in some parts of the United States, but, fortunately, they usually are not of such severity or extent as seriously to reduce yields of agricultural products when considered from a national viewpoint. However, at rather long intervals a number of years in succession bring what may be called "families" of droughts. These are more frequent and pronounced in the normally drier sections, such, especially, as the western Plains. Any long-time agricultural program that does not take this weather characteristic into account is inherently weak.

The last extended drought of this character in the United States that is broadly comparable to conditions prevailing from about 1930 to 1936, especially the three bad drought years 1930, 1934, and 1936, occurred in the period cover-

ing the latter part of the 80's up to about the middle of the 90's of the last century. Following this there was a series of years with comparatively abundant rainfall, and the current reaction to much more favorable crop weather suggests very strongly that the recent long drought period has about spent itself and that immediate future years will have more abundant rainfall. However, weather history repeats itself. While the successions of relatively long-time dryness and wetness are irregular and as yet not definitely predictable, should there now develop for several immediate future years a return to abnormally heavy rainfall, such as followed previous drought epochs, in the naturally drier midwest sections, a false optimism that favorable weather will continue indefinitely should be avoided. Long-time rainfall records show that such a condition is abnormal and transient and that future years will bring droughts just as severe as those of the recent past. Therefore, a sensible land-use program must take this all-important, basic fact into account by providing an agriculture adapted to the drier epochs rather than a temporary expedient in cultivation that can "get by" only in the wetter years.

Table 1 shows the percentage of the normal March-August rainfall in the principal grain areas for 14 of the driest seasons and for a like number of the wettest seasons since 1886. Of these 14 dry years, a total of 9 occurred in the 2 extensive drought periods as before indicated, 5 in the period 1886–95, and 4 in the period 1930–36, although one of the outstanding wet seasons, 1892, occurred in the first general dry period, and one relatively wet season, 1935, within the more recent period of drought.

TABLE 1.—*Percentage of normal March–August rainfall in principal grain areas*[1]

DRY YEARS

Year	Montana	North Dakota	South Dakota	Nebraska	Kansas	Oklahoma	Missouri	Iowa	Minnesota	Wisconsin	Michigan	Illinois	Indiana	Ohio	Kentucky	Weighted average
1936	65	43	50	57	52	44	41	58	64	74	71	55	66	77	72	61
1934	69	53	57	48	55	63	61	65	66	78	76	71	78	77	90	65
1930	75	76	81	107	89	81	55	83	78	83	72	58	60	61	47	75
1910	84	67	68	72	79	72	96	62	53	65	78	83	84	71	110	76
1894	99	89	80	55	70	76	76	58	84	84	90	66	78	68	70	78
1931	61	81	63	70	85	83	88	81	79	76	83	92	97	104	92	79
1889	55	62	82	103	120	86	87	85	74	80	87	92	89	79	78	81
1895	70	111	88	89	112	105	102	92	90	73	67	80	64	61	85	84
1926	76	77	77	77	73	48	84	82	78	103	97	95	106	100	95	84
1886	74	89	91	93	98	46	73	59	102	86	93	90	106	93	103	86
1901	98	114	100	88	75	76	59	69	95	86	95	68	83	97	85	88
1925	99	96	82	89	93	76	83	83	95	89	75	78	84	81	75	88
1887	111	107	122	89	90	70	77	61	89	73	71	69	79	82	72	89
1911	109	98	74	78	72	81	73	74	104	99	95	84	91	95	90	90

WET YEARS

1915	138	107	140	157	160	153	130	122	108	94	96	125	117	104	105	124
1892	113	116	133	114	113	128	116	139	140	135	121	130	133	118	110	123
1927	133	134	127	111	141	132	150	89	94	92	87	144	132	111	123	121
1902	117	123	105	122	137	110	114	151	118	111	117	127	108	104	80	118
1905	101	117	133	137	111	133	113	115	136	127	121	103	122	115	108	118
1908	137	104	112	122	125	150	117	128	129	80	108	112	105	109	110	117
1903	111	105	109	126	123	93	105	133	127	132	115	100	103	106	90	115
1896	101	131	103	117	113	70	113	128	124	109	109	111	127	119	113	114
1888	125	105	100	113	102	90	108	117	114	114	92	117	107	105	107	111
1906	131	119	120	104	106	128	90	94	121	105	95	85	99	101	102	109
1909	121	111	108	89	103	77	104	114	104	98	106	110	125	118	118	109
1912	119	125	99	88	104	99	108	89	97	118	109	110	131	117	130	109
1898	128	92	80	90	114	128	137	99	95	94	93	131	119	114	112	108
1935	83	124	97	107	101	118	129	102	114	105	98	126	124	110	154	108

[1] Data given in order of weighted averages for all States—dry years, 61 to 90 percent; wet years, 108 to 124 percent.

Table 2 shows the percentage of normal summer (June–August) rainfall for the 11 principal Corn Belt States, grouped as in the other case, by outstandingly dry and wet summers. The importance of rainfall to agriculture is shown by the fact that corn yields for the entire United States averaged 23 percent greater for the 14 wettest summers than for the 14 driest for the 11 principal Corn Belt States alone. This difference of 5.3 bushels per acre, on a recent normal acreage, means nearly 500,000,000 bushels of corn a year in favor of the wet summers.

TABLE 2.—*Percentage of normal summer (June–August) rainfall in 11 Corn Belt States*[1]

DRY YEARS

Year	South Dakota	Nebraska	Kansas	Oklahoma	Missouri	Iowa	Minnesota	Illinois	Indiana	Ohio	Kentucky	Weighted average
1936	42	43	31	30	31	57	52	52	57	77	57	45
1894	66	58	70	49	64	42	43	48	55	54	64	54
1913	78	65	41	56	54	66	108	67	81	88	63	68
1930	74	91	84	68	55	82	71	60	61	57	44	70
1933	69	80	86	102	64	68	59	62	62	70	90	73
1934	74	59	50	59	64	86	79	95	100	95	114	75
1893	62	79	98	111	91	81	77	60	59	73	81	81
1910	70	85	80	78	103	65	54	85	94	68	138	81
1918	100	75	60	70	67	102	88	91	92	81	84	81
1922	107	85	84	72	77	94	66	65	71	90	85	81
1901	126	87	66	56	49	62	107	71	83	96	90	83
1886	86	81	106	61	73	36	90	83	125	91	106	84
1929	70	77	94	72	99	83	62	111	108	106	84	84
1931	63	67	74	80	88	83	86	94	105	112	99	84

WET YEARS

1915	159	164	164	169	163	129	116	165	150	139	136	150
1928	112	106	143	136	158	136	134	134	136	129	160	135
1902	103	144	149	70	133	189	117	161	124	126	76	126
1905	143	132	106	111	127	105	140	110	126	119	118	123
1907	101	109	114	105	111	143	113	146	128	113	115	117
1904	98	122	152	156	134	95	104	111	80	89	76	114
1908	109	147	147	145	103	119	111	82	66	84	92	114
1891	91	158	117	117	121	116	95	99	111	107	119	113
1924	105	100	97	89	135	144	113	143	113	103	91	113
1906	107	89	117	164	105	92	115	90	106	121	123	110
1895	84	99	151	168	134	103	93	103	76	68	95	109
1900	118	106	87	87	103	125	129	117	129	103	114	109
1923	136	123	113	88	100	102	92	99	112	103	118	109
1932	96	102	114	132	113	130	85	120	112	92	111	109

[1] Data given in order of weighted averages for all States—Dry years, 45 to 84 percent; wet years, 109 to 150 percent.

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171

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